

A REVIEW OF THE GROUPERS (PISCES: SERRANIDAE: EPINEPHELINAE) OF THE RED SEA, WITH DESCRIPTION OF A NEW SPECIES OF *CEPHALOPHOLIS*

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ABSTRACT

The following 22 groupers (Serranidae: Epinephelinae) occur in the Red Sea: *Aethaloperca rogaa*, *Anyperodon leucogrammicus*, *Cephalopholis argus*, *C. hemistiktos*, *C. miniata*, *C. oligosticta* new species, *C. sexmaculata*, *Epinephelus areolatus*, *E. chlorostigma*, *E. epistictus*, *E. fasciatus*, *E. fuscoguttatus*, *E. latifasciatus*, *E. malabaricus*, *E. microdon*, *E. morrhua*, *E. stoliczkae*, *E. summana*, *E. tauvina*, *Plectropomus maculatus*, *P. truncatus*, and *Variola louti*. *C. oligosticta* and *E. summana* are endemic to the Red Sea (*summana* has a close relative, *E. ongus*, from elsewhere in the Indo-Pacific). *C. hemistiktos* and *E. stoliczkae* are known only from the seas around the Arabian Peninsula; *C. hemistiktos* appears to be subspecifically different in the Gulf of Oman and Persian Gulf. The remaining species are wide-ranging in the Indo-Pacific.

A rare giant serranid fish, probably *Promicrops lanceolatus*, has been taken in the Red Sea, but we have no specimens to confirm the identification.

Records of *Cephalopholis boenack*, *Epinephelus caeruleopunctatus*, and *E. merra* from the Red Sea appear to be in error.

The Red Sea record of *Epinephelus hexagonatus* by Klunzinger (1870) may be a misidentification of *E. quoyanus* (*E. gilberti* and *E. megachir* are junior synonyms). Although *E. quoyanus* might be expected from the Red Sea we withhold formal reporting of it until specimens are examined.

A key to the Red Sea groupers is presented, and for each species we give the primary synonyms, diagnosis, illustration, and remarks on distribution, habitat, size, and location of types.

C. oligosticta is orange-red with scattered small blue spots. It most resembles *C. miniata*, differing in having 60-71 lateral-line scales (compared to 47-54 for *miniata*), longer pelvic fins (1.6-1.95 in head), longer dorsal spines (2.9-3.15 in head), a serrate ventral preopercular margin, and fewer blue spots. It is usually found in dead reef areas at depths greater than 25 m.

The serranid fishes, popularly known as groupers, are among the most valuable food fishes of tropical and subtropical seas. In spite of their importance, much confusion exists in their classification, particularly the large genera *Epinephelus* Bloch and *Cephalopholis* Schneider. The Indo-Pacific species of these two genera are in great need of systematic revision. Because there are only 22 identified species of groupers in the Red Sea, which is a relatively small number compared to most other major Indo-Pacific areas, it has been possible to provide the present synopsis of these species with some confidence.

Following Katayama (1960) and other authors, we classify the groupers in the subfamily Epinephelinae. Other serranid subfamilies represented in the Red Sea are the Serraninae (one species of *Serranus*—Klunzinger, 1884), Liopropominae (two species of *Liopropoma*—Lubbock and Randall, 1978), and the Anthiinae (one species of *Plectranthias*—Randall, 1980a, and four species of *Anthias*, Heemstra and Randall, MS). The two soapfishes which are found in the Red Sea have been placed in a separate family, Grammistidae, by Randall et al., 1971 (though many authors have regarded this group as a subfamily of the Serranidae).

The generic classification of the Epinephelinae is not stabilized. Most recent

authors have recognized the genera as used in the present paper, but Smith (1971) concluded that *Cephalopholis*, *Promicrops*, *Dermatolepis* and *Alphestes* should be regarded as subgenera of *Epinephelus*. He based his conclusions on a comprehensive study of American groupers. He was strongly influenced in combining *Cephalopholis* with *Epinephelus* by the "discovery that the Eastern Pacific species *acanthistius* belongs to the subgenus *Epinephelus* rather than to *Cephalopholis* despite its having nine dorsal spines." Although this species does break down the convenient dorsal spine count difference employed by most authors to separate *Cephalopholis* and *Epinephelus*, further study of its generic affinity seems advisable. Jordan and Evermann (1896) created the subgenus *Enneistus* for this grouper based on "its smooth scales, naked maxillary, and elevated spinous dorsal, which is deeply notched as in *Paralabrax*." Jordan et al. (1930) raised *Enneistus* to generic rank.

We agree with Schultz in Schultz and collaborators (1966) in using the genus *Promicrops* for the giant grouper *P. lanceolatus* (Bloch) instead of *Epinephelus*. Schultz has tabulated the differences between these two genera.

Our failure to follow Smith's concept of grouper genera is not an indication that we wholly disagree with him but rather to conform to that which is generally accepted. Much research on the systematics of Indo-Pacific Serranidae remains. When this is completed, a definitive classification of the genera of Epinephelinae may emerge.

The earliest valid Red Sea grouper names were bestowed by Forsskål (1775); he described eight of the species. Bloch (1790) named two, Bloch and Schneider (1801) one, Cuvier in Cuvier and Valenciennes (1828) two, Rüppell (1828) two, Valenciennes in Cuvier and Valenciennes (1833) one, Temminck and Schlegel (1842) two, Bleeker (1856a) one, Day (1875) one, and Fowler and Bean (1930) one. The twenty-second species, *Cephalopholis oligosticta*, known only from the Red Sea is described herein.

A species of giant grouper occurs in the Red Sea. Ben-Tuvia (1968) reported one of 2,500 mm total length and approximately 300 kg from the Ethiopian coast which he identified as *Epinephelus tauvina*. A photograph of this fish taken at Massawa with men standing beside it indicates its immense size; unfortunately, the photo shows only the ventral view of the fish. From size alone we now know that it is not *E. tauvina* (see discussion of *tauvina* below). Two other larger groupers of about 1,200 mm total length have been landed at Eilat (also spelled Elat) in the Gulf of Aqaba. This species is probably *Promicrops lanceolatus* (Bloch), but we do not have any specimens to confirm the identification.

A few species of groupers have been erroneously reported from the Red Sea. Weber and de Beaufort (1931) included the Red Sea in a list of localities for *Cephalopholis boenack* (Bloch), but without any apparent valid basis. Steinitz and Ben-Tuvia (1955), Roux-Estève and Fourmanoir (1955) and Roux-Estève (1956) recorded *Epinephelus merra* (Bloch) from the sea. These records appear to represent misidentifications of *E. tauvina* (Forsskål). A photograph of one of Roux-Estève and Fourmanoir's Red Sea specimens of *E. merra* (MNHN 52-54, 151 mm SL) was kindly sent by M.-L. Bauchot of the Museum National d'Histoire Naturelle, along with fin-ray and gill-raker counts. This information clearly shows that the fish in question is *E. tauvina*. Records of *E. caeruleopunctatus* (Bloch) from the Red Sea, as by Weber and de Beaufort (1931), appear to be misidentifications of *E. summana* (Forsskål). This seems to have arisen from regarding *Serranus leucostigma* [Ehrenberg MS] Valenciennes in Cuvier and Valenciennes (1828), which has a type locality of Red Sea, as a juvenile of *E. caeruleopunctatus* when in fact it is a juvenile of *E. summana*.

Klunzinger (1870) listed *Serranus hexagonatus* (Bloch and Schneider) from the Red Sea; however, his mention of two rows of teeth in the lower jaw and some specimens with 17 dorsal soft rays would rule out *hexagonatus*. Possibly he had specimens of *Epinephelus quoyanus* Valenciennes [senior synonym of *E. gilberti* (Richardson) and *E. megachir* (Richardson)].

E. quoyanus is distinctive in having numerous moderately large close-set dark spots which may be hexagonal, two dark bands on thorax anterior to pectoral fin, 16 to 18 dorsal soft rays, 17 or 18 pectoral rays, 7–8 + 14–16 gill rakers and long pectoral fins (1.2–1.5 in head). *E. macrospilos* (Bleeker) has a similar color pattern but the spots are not as close-set and more round; also it has spots, not bands, anterior to the pectoral fin; the pectoral rays are usually 19 and the length of these fins 1.65–1.75 in the head. We have not seen any specimens of *E. quoyanus* from the Red Sea and prefer not to include this species without examining material.

MATERIALS AND METHODS

Type specimens of the new species of *Cephalopholis* have been deposited in the Bernice P. Bishop Museum, Honolulu (BPBM); British Museum (Natural History), London (BMNH); California Academy of Sciences, San Francisco (CAS); Hebrew University, Jerusalem (HUJ); Muséum National d'Histoire Naturelle, Paris (MNHN); Naturhistorisches Museum, Vienna (NMW); J. L. B. Smith Institute of Ichthyology, Grahamstown (RUSI); Senckenberg Museum, Frankfurt (SMF); and the U.S. National Museum of Natural History, Washington, D.C. (USNM). Specimens of groupers for this study were examined at these institutions (except the museum in Vienna) as well as the Academy of Natural Sciences of Philadelphia (ANSP), Rijksmuseum van Natuurlijke Historie, Leiden (RMNH), Universitets Zoologiske Museum, Copenhagen (ZMC), and Zoologisches Museum der Humboldt-Universität, East Berlin (ZMB).

In the description of the new species, data in parentheses refer to paratypes. Proportional measurements in the text are rounded to the nearest 0.05. Fin-ray, scale, and gill-raker counts were made from all the type specimens.

Standard length (SL) was measured from the most anterior end of the upper lip in the median line to the base of the caudal fin (posterior end of hypural plate). Head length was measured from the same anterior point to the posterior end of the opercular flap. Body depth is the greatest depth, taken from the base of the dorsal spines to the ventral margin of the thorax or abdomen (corrected for any obvious malformation of preservation). Width of body was measured just posterior to the gill opening. Orbit diameter is the greatest fleshy diameter. The length of the upper jaw was taken from the front of the upper lip to the posterior end of the maxilla. The depth of the caudal peduncle is the least depth; the length of the peduncle was measured horizontally between verticals at the rear base of the anal fin and base of the caudal fin. The lengths of the fin spines and rays were measured from the tips to their extreme bases. Pectoral-fin length was taken from the distal tip of the longest ray to the extreme base of that ray. Lateral-line scale counts were made to the base of the caudal fin. The upper-limb gill-raker count is presented first; the raker at the angle is contained in the lower-limb count. Gill-raker counts include all rudiments when discernible. Large specimens of some species may exhibit a fusion of the sessile rakers, especially anteriorly on the lower limb. Also, small intercalary rakers may develop between the principal rakers (the intercalary rakers were not counted). When fusion or intercalary rakers prevent an accurate total count of the gill rakers, only the developed rakers were enumerated (these are defined as rakers which are higher than the length of their base).

The species accounts which follow the key are presented in alphabetical order by genus and species.

KEY TO THE GROUPERS (EPINEPHELINAE) OF THE RED SEA

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|--|----|
| 1a. Dorsal rays IX or XI, 12–18; no enlarged canine teeth on side of lower jaw; no antrorse spines on ventral margin of preopercle; head not short, 2.2–2.75 in SL | 2 |
| 1b. Dorsal rays VIII, 11; one to 4 large fixed canine teeth on side of lower jaw; three antrorse spines on ventral margin of preopercle; head short, 2.8–3.1 in SL | 21 |
| 2a. Dorsal spines IX | 3 |
| 2b. Dorsal spines XI | 9 |
| 3a. Caudal fin truncate to rounded; anal soft rays 9; longest anal ray 1.6–2.5 in head; color not as in 3b | 4 |
| 3b. Caudal fin lunate; anal soft rays 8; longest anal ray 1.1–1.5 in head; yellowish brown to | |

- orange-red with numerous small irregular pink to blue spots; posterior margins of fins broadly yellow *Variola louti*
- 4a. Depth of body 2.6–3.7 in SL; caudal fin rounded; pelvic fins not extending posterior to anus, 1.7–2.4 in head; color not as in 4b 5
- 4b. Depth of body 2.1–2.4 in SL; caudal fin truncate; pelvic fins extending posterior to anus, 1.4–1.6 in head; uniform dark brown, often with a bluish white bar on lower half of middle of body *Aethaloperca rogaa*
- 5a. Dorsal soft rays 16 or 17; lower-limb gill rakers 17–19; auxiliary scales present on body; dark brown with numerous black-edged blue spots on head, entire body and fins; five or six broad pale bars may be present on posterior half of body *Cephalopholis argus*
- 5b. Dorsal soft rays 14 or 15; lower-limb gill rakers 13–16; auxiliary scales not present on body; color not as in 5a 6
- 6a. Ventral margin of preopercle serrate; lateral-line scales 60–71; orange-red with widely scattered light blue spots over entire body and elongate spots or short lines on head *Cephalopholis oligosticta*, new species
- 6b. Ventral margin of preopercle smooth (fleshy); lateral-line scales 47–56; color not as in 6a (may be orange-red with blue spots, but spots much denser) 7
- 7a. Distal posterior corners of dorsal and anal fins angular, the longest dorsal soft ray 2.05–2.35 in head; dark brown to red, the caudal fin and posterior dorsal and anal fins darker than body, with small dark-edged blue spots on head (especially ventrally) and lower half of body *Cephalopholis hemistiktos*
- 7b. Distal posterior corners of dorsal and anal fins rounded, the longest dorsal ray 2.2–2.65 in head; color not as in 7a (blue spots present over entire body) 8
- 8a. Dorsal spines relatively short, the longest 3.3–3.5 in head; no series of dark blotches along back *Cephalopholis miniata*
- 8b. Dorsal spines not short, the longest 2.95–3.2 in head; a series of six large quadrangular dark brown spots dorsally on body (four along base of dorsal fin and two on caudal peduncle), usually with dark bars extending across body from these spots (bars from spots at base of dorsal fin bifurcating as they pass ventrally) *Cephalopholis sexmaculata*
- 9a. Palatine teeth present; body not elongate, the depth 2.6–3.3 in SL (except *E. latifasciatus*, *E. malabaricus*, and *E. tauvina*); color not as in 9b 10
- 9b. Palatine teeth absent; body relatively elongate, the depth 3.3–3.7 in SL; greenish gray to brown with numerous small orange-red spots *Anyperodon leucogrammicus*
- 10a. Caudal fin slightly emarginate; head, body and fins with numerous small close-set brown to dark brown spots (no other dark markings on body or fins) 11
- 10b. Caudal fin rounded; numerous small brown spots present or absent (if present, other prominent dark markings evident) 12
- 11a. Posterior portion of anal fin round to slightly angular, the longest rays 2.3–2.6 in head; dorsal soft rays usually 16; pectoral fins relatively long, 1.6–1.8 in head; lower-limb gill rakers 14–16 *Epinephelus areolatus*
- 11b. Posterior portion of anal fin distinctly angular, the longest rays 1.9–2.5 in head; dorsal soft rays usually 17; pectoral rays not long, 1.75–2.0 in head; lower-limb gill rakers 15–18 *Epinephelus chlorostigma*
- 12a. Dorsal soft rays 14–18; color not as in 12b 13
- 12b. Dorsal soft rays 12 or 13; light gray with four longitudinal dark brown lines on head and body (may be broken into spots and dashes on large individuals); dorsal and caudal fins yellowish with black spots *Epinephelus latifasciatus*
- 13a. Lower-limb gill rakers 15–21; dorsal soft rays 14–17 (only *E. fasciatus* with 17); color not as in 13b 14
- 13b. Lower-limb gill rakers 13–15; dorsal soft rays 16–18; yellowish to brownish gray with small reddish brown spots on head and anterior two-thirds of body the posterior half of body with three pale bars *Epinephelus stoliczkae*
- 14a. Corner of preopercle with a very prominent rounded posterior projection bearing three to five greatly enlarged serrae; two straight diagonal dark bands across cheek (in addition to one posterior from eye); deep-water species 15
- 14b. Corner of preopercle with no or only a slight posterior projection, the serrae not greatly enlarged; no straight diagonal dark bands on cheek (bands, if present, irregular); shallow-water species 16
- 15a. Body with four diagonal dark brown bands, the posterior ends of which broaden where they end dorsally on body (middle two bands joined anterior to a point above distal part of pectoral fin); an irregular row of dark brown spots in pale spaces between dark bands; pectoral fins 1.9–2.3 in head *Epinephelus morrhua*
- 15b. Body without dark brown bands; body with irregular rows of small brown spots (spots more evident on juveniles than adults), pectoral fins 1.65–2.05 in head *Epinephelus epistictus*

- 16a. Color pattern dominated by small dark brown, orangish, or white spots; tips of spinous dorsal membranes without a black submarginal zone; dorsal spines not long, the longest 2.75–4.6 in head; dorsal soft rays 14–16 17
- 16b. Color pattern not dominated by spots (body with dusky to reddish bars or large squarish blotches forming bars); triangular distal part of spinous dorsal membranes black (except for pale cirrus at tip); dorsal spines relatively long, the longest 2.4–2.7 in head; dorsal soft rays 16 or 17 *Epinephelus fasciatus*
- 17a. Body moderately elongate, the depth 3.1–3.6 in SL; lateral-line scales 58–74; dorsal margin of opercular membrane slightly convex; dark spots on body of adults not very small and not close-set 18
- 17b. Body not elongate, the depth 2.6–3.1 in SL; lateral-line scales 48–58; dorsal margin of opercular membrane strongly convex; dark spots on body (*E. summana* excepted; its small spots are white) very small and close-set (their diameter generally less than spaces between spots) 19
- 18a. Lateral-line scales 67–74; teeth on side of lower jaw in three or four rows; snout not relatively long, its length 4.5–5.0 in head; upper jaw very long, its length 1.95–2.05 in head; large blackish spot on back at base of last three dorsal spines darker than other spots on back; slightly diagonal dark bars on body faint or absent *Epinephelus tauvina*
- 18b. Lateral-line scales 58–64; teeth on side of lower jaw in two rows; snout relatively long, its length 3.3–4.4 in head; upper jaw not very long, its length 2.1–2.25 in head; large dark spot on back at base of last dorsal spines not darker than other large spots on back; five vertical to slightly diagonal dark bars on body (bars bifurcate ventrally) *Epinephelus malabaricus*
- 19a. Color pattern of body of adults a coarse dark brown reticulum enclosing large roundish light brown spots, this pattern overlaid with numerous small white spots; no prominent black spot dorsally on caudal peduncle (a brown spot may be present but it merges with rest of dark reticulum); maxilla reaching or extending slightly posterior to a vertical at rear edge of orbit, the upper jaw length 2.2–2.4 in head *Epinephelus summana*
- 19b. Color pattern not as in 19a (no white spots present); a prominent black saddle-like spot dorsally on caudal peduncle; maxilla reaching well posterior to rear edge of orbit, the upper jaw length 1.8–2.1 in head 20
- 20a. Pectoral rays 16 or 17; gill rakers 9–10 + 16–18; pectoral fins relatively long, their length 1.65–1.95 in head; dorsal profile of head of adults smoothly convex; large dark blotches on body slightly irregular; no pale bars on lips *Epinephelus microdon*
- 20b. Pectoral rays 18–20; gill rakers 10–12 + 18–21; pectoral fins not relatively long, their length 1.9–2.4 in head; dorsal profile of head of adults not smoothly convex (profile a double convexity, the two curves meeting just behind eye); two pale bars across side of lips *Epinephelus fuscoguttatus*
- 21a. Caudal fin emarginate, the caudal concavity 4.7–7.6 in head; suborbital depth 5.8–7.8 in head; interorbital space naked; gill raker at angle of first gill arch longer than gill filaments; blue spots well separated, some on head and anteriorly on body often enlarged and/or elongate *Plectropomus maculatus*
- 21b. Caudal fin truncate to slightly emarginate; suborbital depth 8.0–9.9 in head; interorbital space scaled (scales embedded in adults); gill raker at angle of first gill arch shorter than gill filaments; blue spots close-set, none enlarged or elongate *Plectropomus truncatus*

Aethaloperca rogaa (Forsskål)

Figures 1 and 2

Perca rogaa Forsskål, 1775: 38 (type locality, Jeddah).

Perca lunaria Forsskål, 1775: 39 (type locality, Jeddah and Lohaja).

Diagnosis.—Dorsal rays IX, 17 or 18 (usually 18); anal rays III, 9 (one of 16 specimens with 8); pectoral rays 17 or 18 (usually 18); pored lateral-line scales 48–55; oblique rows of scales from upper end of gill opening to base of caudal fin 95–104; head fully scaled; auxiliary scales present on head as well as body; gill rakers 9–11 + 14–17; body deep, the depth 2.1–2.5 in SL, and compressed, the width 2.25–2.8 in depth; teeth on side of lower jaw in three or four irregular rows; head length 2.6–2.75 in SL; snout length 3.2–3.8 in head; maxilla extending well beyond orbit, the upper jaw length 1.85–1.95 in head; interorbital space convex; opercular spines large and very flat, the middle one largest and most posterior, nearer lower than upper spine; dorsal margin of opercular membrane very convex;

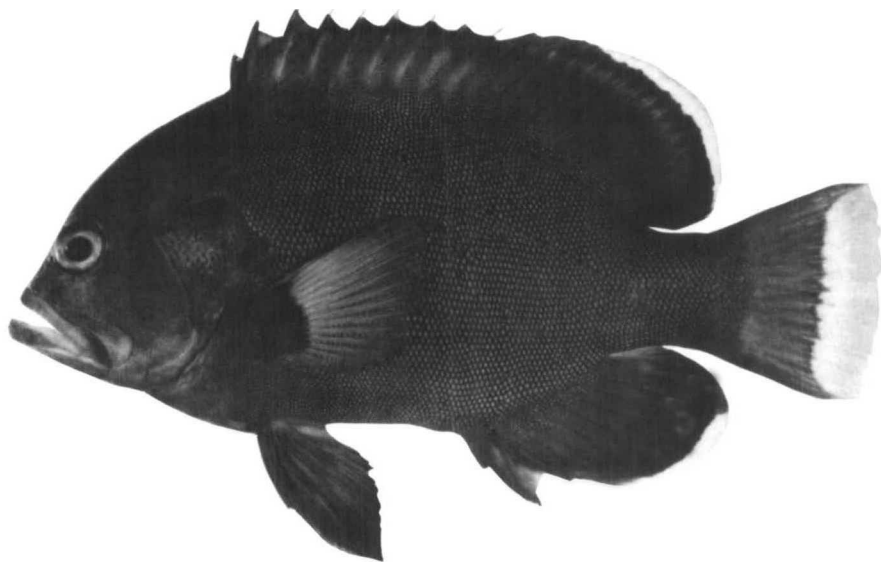


Figure 1. *Aethaloperca rogaa*, BPBM 21650, 89 mm SL, Seychelles.

upper margin of preopercle finely serrate, the lower margin smooth; margin of subopercle and interopercle partially and finely serrate; third or fourth dorsal spine longest, 2.7–2.9 in head; soft portions of dorsal and anal fins of adults distinctly angular, the ninth or tenth dorsal rays longest, 1.6–1.85 in head, the fourth or fifth anal rays longest, 1.6–1.75 in head; caudal fin truncate, 1.5–1.7 in head; fifth or sixth pectoral rays longest, 1.5–1.6 in head; pelvic fins long, reaching well beyond anus, 1.4–1.65 in head, broadly rounded in adults.

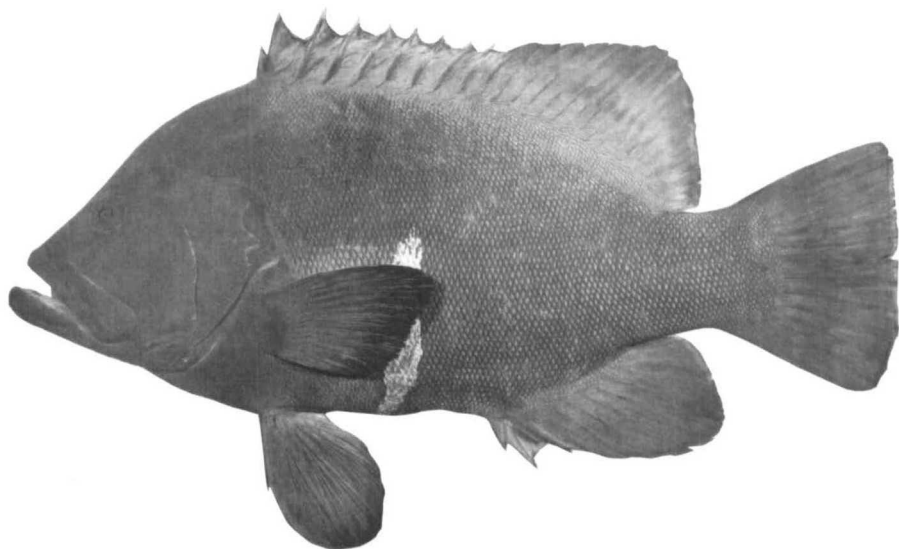


Figure 2. *Aethaloperca rogaa*, BPBM 16234, 258 mm SL, Solomon Islands.

COLOR OF ADULTS WHEN FRESH. Dark brown, sometimes with a slight orange cast; area under maxilla and groove around lips deep orange; mouth largely bright orange-red, but some parts white; unscaled distal part of spinous portion of dorsal fin deep orange to brownish red; posterior border of caudal fin very narrowly whitish. A color marking often seen in life is a whitish bar centered on the abdomen.

Color of an 89-mm juvenile from Seychelles (BPBM 21650) when fresh: dark brown, the centers of scales of body lighter than edges; dorsal and anal fins dark brown, the soft portions with a distinct whitish border and black submarginal band, the dorsal with an indistinct yellow band proximal to the black; caudal fin brownish yellow, the outer third white (except along upper and lower edges where the brownish yellow curves to the corners of the fin); pectoral fins with brownish yellow rays, clear membranes, and a large blackish spot covering base; pelvic fins dark brown.

Remarks.—The above diagnosis is based on 10 Red Sea specimens from the British Museum (Natural History), Muséum National d'Histoire Naturelle in Paris and Senckenberg Museum in Frankfurt and nine specimens from the Academy of Natural Sciences of Philadelphia and the Bishop Museum extralimital to the Red Sea. Measurements were made on 13 of these specimens, 167–318 mm SL.

A. rogaa occurs throughout the Red Sea and tropical Indian Ocean to the Western Pacific. Boulenger (1895) examined specimens from the Red Sea, Zanzibar, Muscat, and Sri Lanka (Ceylon). Smith (1953) recorded it at Delagoa Bay, Mozambique, and Smith and Smith (1963) from the Seychelles. The senior author has photographed it underwater in the Maldives. Oddly, it is still unknown from Madagascar, Réunion, and Mauritius. Baissac (1976) did not include it from Mauritius, and the senior author never observed it there during four visits totaling 10 weeks of diving and fish collecting. Fowler (1904) listed it from Sumatra and proposed the subgenus *Aethaloperca* for the species in that paper. Fowler and Bean (1930) reported specimens from a number of Philippine localities and Borneo. Masuda et al. (1975), included it from Wakayama Prefecture, southern Japan. Whitley (1964) recorded it from Swains Reef, Southern Great Barrier Reef. The Australian Museum has specimens from Lizard Island, Great Barrier Reef and Abaiang, Gilbert Islands (now Kiribati) (John R. Paxton, personal communication). The Bishop Museum has specimens from the Seychelles, Gulf of Oman, Belau (Palau Islands) (Helfman and Randall, 1973), and the Solomon Islands. The last-mentioned locality is represented by one 258-mm fish (BPBM 16234) taken at Alite Reef off Malaita in only 3 m. This species has been observed to depths of 40 m; no doubt it ranges into deeper water than this. Typically it is found on well-developed coral reefs in clear water, generally in the vicinity of caves.

The stomachs of four adults were opened for food material. All were empty except one which contained fish remains.

Boulenger (1895) recorded the total length to 550 mm, and Smith (1953) to 24 inches (610 mm).

Some authors have classified *roga* in the genus *Cephalopholis*. We prefer to place the species by itself in *Aethaloperca*. It is distinctive from other *Cephalopholis* in its deeper body (except *C. igarashiensis* Katayama—see below), steep dorsal profile of head, truncate caudal fin, elevated and angular soft portions of the dorsal and anal fins, elongate pelvic fins, and 17 or 18 dorsal soft rays (14–16 for other *Cephalopholis* except rarely 17 for *argus*). *C. igarashiensis* has a body depth about as great as that of *A. rogaa*, but other differences suggest that it

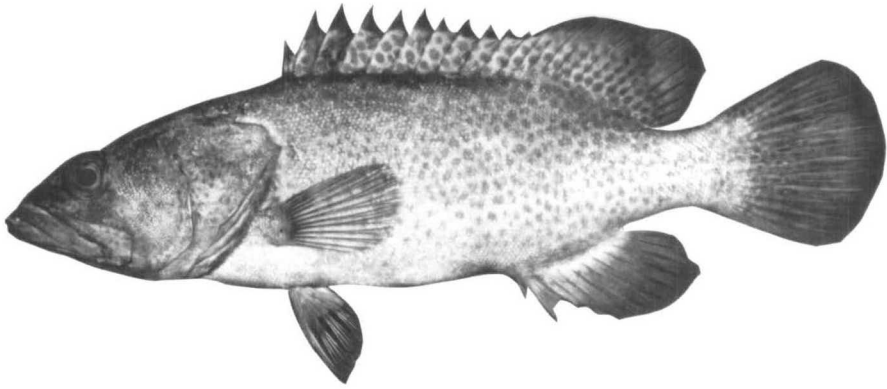


Figure 3. *Anyperodon leucogrammicus*, BPBM 20729, 294 mm SL, Sudan.

developed this independently from *rogaa*. It differs notably in having 14 dorsal soft rays, a rounded caudal fin, rounded and relatively short soft portions of the dorsal and anal fins, and a naked maxilla.

The type specimens of *Perca rogaa* Forsskål and *Perca lunaria* Forsskål are not extant (Klausewitz and Nielsen, 1965).

Anyperodon leucogrammicus (Valenciennes)

Figure 3

Serranus leucogrammicus Valenciennes in Cuvier and Valenciennes, 1828: 347 (type locality, Seychelles).

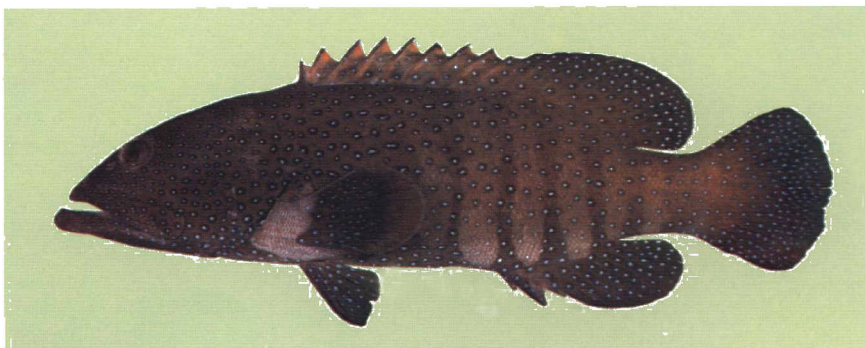
Serranus micronotatus Rüppell, 1838: 90 (type locality, Massaua, Red Sea).

Serranus urophthalmus Bleeker, 1855: 310 (type locality, Batu Archipelago).

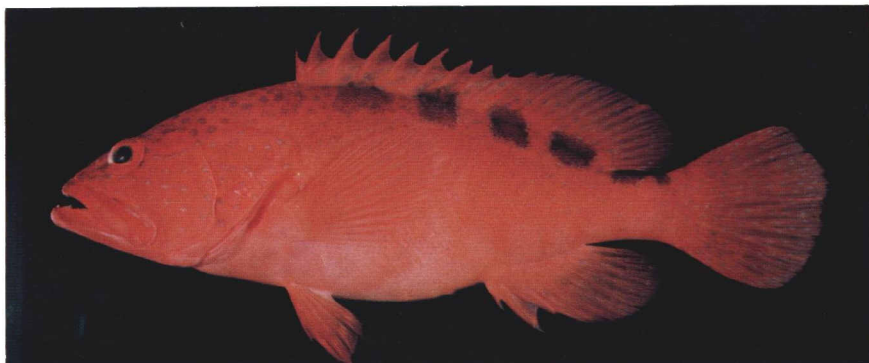
Diagnosis.—Dorsal rays XI, 14–16 (usually 15); anal rays III, 8 or 9 (usually 9); pectoral rays 15–17; lateral-line scales 63–71; oblique rows of scales from upper end of gill opening to base of caudal fin 110–125; head fully scaled; auxiliary scales present on head and body; gill rakers 7–9 + 14–17; body elongate, the depth 3.3–3.7 in SL; head pointed, its length 2.4–2.5 in SL; snout length 3.9–4.3 in head; mouth large, the maxilla extending clearly posterior to hind margin of orbit, the upper jaw length 2.0–2.2 in head; no palatine teeth (present in other groupers discussed herein); teeth along side of jaws very small, in two to three irregular rows; interorbital space slightly concave to slightly convex; middle opercular spine nearer lower than upper spine; dorsal margin of opercular membrane convex; preopercular corner forming an obtuse angle of about 125°, the upper margin finely serrate, the lower smooth; subopercle and interopercle with 0 to a few serrae; dorsal spines slender, the longest (fourth) 2.7–3.5 in head; tips of posterior dorsal soft rays reaching posterior to base of caudal fin; longest dorsal soft ray 2.5–2.9 in head; caudal fin rounded; pectoral fins bluntly rounded, 2.1–2.3 in head; pelvic fins not reaching anus, the length 2.2–2.4 in head.

COLOR OF RED SEA SPECIMENS WHEN FRESH. Greenish gray with numerous orange-red spots smaller than pupil of eye on head, body, dorsal fin and basally on caudal fin; fin rays darker than membranes. Juveniles with alternating stripes of blue and red and a blue-edged black spot or two spots at base of caudal fin.

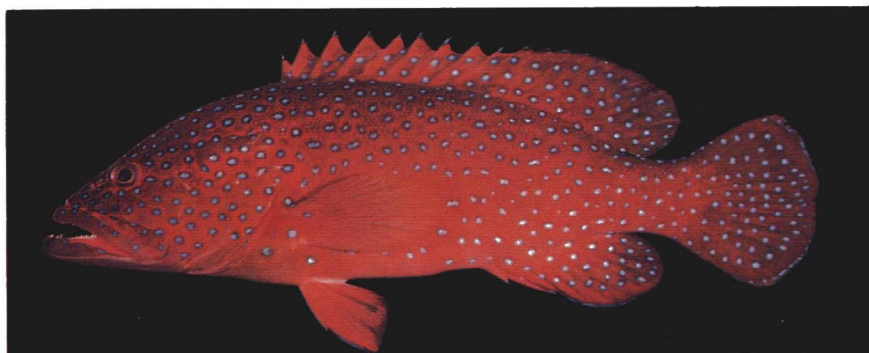
Remarks.—The above diagnosis is based on 29 Red Sea specimens from the Bishop Museum, Senckenberg Museum, and U.S. National Museum of Natural



A. *Cephalopholis argus*, 212 mm SL, BPBM 20756, Sudan, Red Sea.



B. *Cephalopholis sexmaculata*, 200 mm SL, BPBM 18161, Sinai, Red Sea.



C. *Cephalopholis miniata*, 212 mm SL, BPBM 20734, Sudan, Red Sea.



D. *Cephalopholis oligosticta*, holotype, 172.4 mm SL, BPBM 19709 Sudan, Red Sea.

History and 11 specimens of the Academy of Natural Sciences of Philadelphia and Bishop Museum from elsewhere in the Indo-Pacific. Measurement data were taken from 15 of these fish ranging from 143–301 mm SL.

This distinctive species occurs from the Red Sea into Oceania as far as the Marshall Islands (Schultz in Schultz and collaborators, 1953), Kiribati (Gilbert Islands) (Randall, 1955), Samoa Islands (Jordan and Seale, 1906), and Phoenix Islands (Schultz, 1943). In the western Indian Ocean it occurs at Zanzibar (specimens in the J. L. B. Smith Institute of Ichthyology), Seychelles (specimens in collection of Academy of Natural Sciences of Philadelphia), Chagos Archipelago (Kyushin et al., 1977), and Mauritius (Baissac, 1976). In the western Pacific it extends from the Ryukyu Islands (Gushiken, 1972) to New Caledonia (Fourmanoir and Laboute, 1976) and northern Queensland (Grant, 1978). It is a coral reef species more often found on protected than exposed reefs.

The stomachs of seven specimens from 220 to 360 mm SL collected by the senior author at Enewetak, Marshall Islands were opened. All but one, a 248-mm specimen which had eaten a 51-mm wrasse (*Pseudocheilinus evanidus*), were empty.

Outside the Red Sea this grouper usually exhibits four pale longitudinal streaks, the uppermost middorsally on the head and along the dorsal fin base (where it breaks into a series of dashes) and the lowermost (and broadest) from front of snout across head beneath orbit and along lower side of body. Of 29 Red Sea specimens examined, this pattern appeared faintly only in one of 143 mm SL (the holotype of *Serranus micronotatus*). The Red Sea population is further differentiated by having modally one fewer pectoral rays (of 29 Red Sea specimens, 20 had 15 pectoral rays and nine had 16; 10 of 11 specimens extralimital to the Red Sea had 16 pectoral rays and 1 had 17).

As suspected by Boulenger (1895) and concluded by Fowler and Bean (1930), *Anyperodon urophthalmus* (Bleeker) is the young of *A. leucogrammicus*. This is clearly shown by a series of small specimens collected in the Red Sea by Victor G. Springer of the U.S. National Museum of Natural History. Russell et al. (1976) commented on the resemblance of the juvenile *A. leucogrammicus* to the wrasse *Halichoeres biocellatus* Schultz and suggested that the former is mimicking the latter.

The largest of 64 Philippine and East Indian specimens reported by Fowler and Bean (1930) measured 409 mm total length. Masuda et al. (1975) gave the maximum length as 50 cm.

Valenciennes listed both the Moluccas and Seychelles as localities for his syntypes of *Serranus leucogrammicus*. The type locality is here restricted to the Seychelles by the designation of MNHN 7166, 322 mm SL, as the lectotype.

Cephalopholis argus (Schneider)

Plate IA

Perca miniata variety b Forsskål, 1775: 41 (Red Sea).

Bodianus guttatus Bloch, 1790: 36, pl. 224 (type locality, Japan?) (spelled *gutatus* in text but correctly as *guttatus* on plate).

Cephalopholis argus Schneider in Bloch and Schneider, 1801: 311 (type locality, East Indies).

Bodianus jacob-evertsen Lacepède, 1802 (in part): 296.

Serranus myriaster Valenciennes in Cuvier and Valenciennes, 1828: 365 (type locality, Bora Bora).

Diagnosis.—Dorsal rays IX, 16 or 17 (usually 16); anal rays III, 9; pectoral rays 16 or 17 (8 of 28 counts, 16); lateral-line scales 46–50; oblique rows of scales from upper end of gill opening to base of caudal fin 95–103; head fully scaled; auxiliary scales present on body (not on body of other Red Sea species of *Cephalopholis*);

gill rakers 9–11 + 17–19; teeth on side of lower jaw of adults in about six rows; depth of body 2.7–3.2 in SL; head length 2.3–2.55 in SL; snout length 3.5–3.95 in head; maxilla extending well beyond a vertical at posterior edge of orbit, the upper jaw length 1.85–2.0 in head; interorbital space slightly convex; middle opercular spine closer to lower than upper spine; dorsal margin of opercular membrane very convex; ventral margin of preopercle fleshy; interopercle serrate; a few irregular serrae on subopercle; longest dorsal spine 3.0–3.4 in head; longest dorsal soft ray 2.1–2.55 in head; distal tips of posterior dorsal soft rays of adults not reaching base of caudal fin (rays of individuals less than about 120 mm SL may reach caudal base); caudal fin rounded; pectoral fins relatively short, 1.6–2.05 in head; pelvic fins not reaching anus, 2.05–2.35 in head.

COLOR WHEN FRESH. Dark brown with numerous small black-edged blue spots on body, head (where smaller and more numerous), and fins (those on caudal fin also small and numerous); five or six pale bars (broader than dark interspaces) may be present on posterior half of body as well as a large pale area on thorax; posterior margin of median fins and pectoral fins narrowly whitish; triangular distal part of each interspinous membrane of dorsal fin orange.

Remarks.—The above diagnosis is based on four specimens from the Red Sea and 10 specimens from various islands of Oceania. Measurements were taken on seven from 126–315 mm SL.

This species was first described by Forsskål (1775) as variety b of *Perca miniata*. The first author to give it a valid name was Bloch (1790) when he described *Bodianus guttatus*. He stated that his material consisted of three specimens from Japan. One syntype, a dried skin of the right side, remains at the Zoologisches Museum in East Berlin (ZMB 5213, 231 mm SL). If one reads Valenciennes in Cuvier and Valenciennes (1840) on the alleged type locality of Japan given by Bloch for *Scarus japonensis*, it is apparent that Java was probably the true locality. The same may be true of *Bodianus guttatus*. Bloch gave other presumed localities for his *guttatus* from the literature as East Indies, Africa, West Indies, and St. Helena. It is clear, however, that he did not confuse his *guttatus* with *Perca guttata* Linnaeus, for he included an account of the latter, an Atlantic species (Bloch's plate, though labelled The Hind, may have been *Cephalopholis cruentata* as it has only IX dorsal spines).

Perca guttata Linnaeus is the red hind of the tropical western Atlantic, now classified as *Epinephelus guttatus*. When early authors placed groupers in the genus *Serranus*, *Bodianus guttatus* Bloch became a homonym of *Perca guttata* Linnaeus. The same is true when these two nominal species are placed in the genus *Epinephelus*. Though most authors today recognize *Cephalopholis* as a valid genus, some, such as C. L. Smith (1971), consider it as a subgenus of *Epinephelus*. If *Cephalopholis* is recognized as a genus, then *C. guttata* (Bloch) is the valid name for this species which is widely known as *C. argus* today. The specific name *guttata*, however, has not been used for this grouper in the present century. Because of this and the knowledge that *guttata* is a homonym when combined with *Epinephelus*, application has been made to the International Commission for Zoological Nomenclature to suppress the name *Bodianus guttatus* Bloch. We here provisionally retain the name *C. argus* for this species in the expectation of an affirmative decision from the Commission.

C. argus is the most widespread member of the genus in the tropical Indo-Pacific and the most common at most localities (but not the Red Sea). It occurs from the northern Red Sea south to Durban, South Africa (Smith, 1953) and east to Ducie in the Pitcairn Group, the easternmost atoll in Oceania (Rehder and

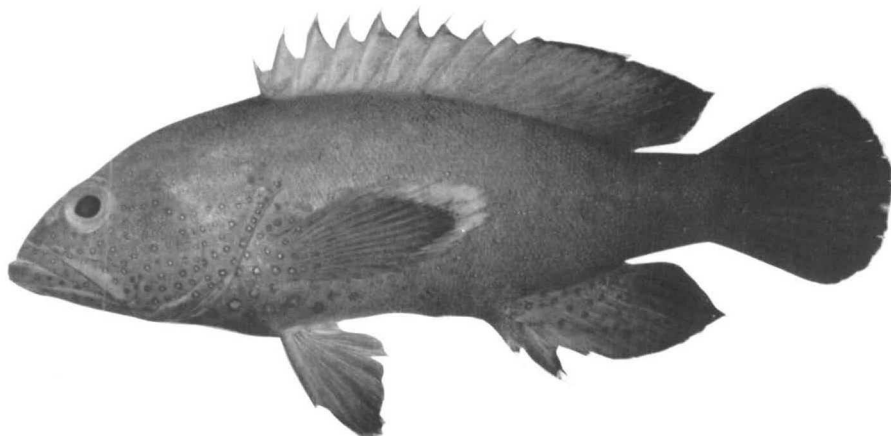


Figure 4. *Cephalopholis hemistiktos*, BPBM 18109, 116 mm SL, Gulf of Aqaba.

Randall, 1975). In the western Pacific it ranges from the Ryukyu Islands (Aoyagi, 1949) to Queensland (McCulloch, 1929) and Lord Howe Island (Allen et al., 1976). There are erroneous reports of its natural occurrence in the Hawaiian Islands beginning with Valenciennes in Cuvier and Valenciennes (1828) who listed the Sandwich Islands as one of two localities for *Serranus myriaster*, a junior synonym of *C. argus*. This grouper was introduced to Hawaii, however, from the Society Islands in 1956 and has become established (Randall and Kanayama, 1972).

C. argus is a shallow-water species that occurs in a variety of reef habitats; it is generally more common on exposed than protected reefs.

The food habits were investigated by Randall (1955), Randall and Brock (1960), Hiatt and Strasburg (1960), Helfrich et al. (1968), Harmelin-Vivien and Bouchon (1976), and Randall (1980b). Approximately 80% of the food material consisted of fishes and nearly all of the remainder crustaceans. This species has been implicated in ciguatera at a number of Pacific islands (Halstead, 1967).

Fowler and Bean (1930) were in error in placing *Cephalopholis kendalli* Evermann and Seale in the synonymy of *C. argus*. *C. kendalli* is a junior synonym of *C. cyanostigma* [(Kuhl and van Hasselt, MS) Valenciennes in Cuvier and Valenciennes].

Cephalopholis hemistiktos (Rüppell)

Figure 4

Serranus hemistiktos Rüppell, 1830: 109, pl. 27, fig. 3 (type locality, Massaua, Red Sea).

Diagnosis.—Dorsal rays IX, 14 (one of 18 specimens with 15); anal rays III, 9; pectoral rays 16–18 (seven of 32 counts of both fins from Red Sea specimens 16, two with 18, the rest 17; one Gulf of Oman specimen and two from Persian Gulf with 18); lateral-line scales 48–51; oblique rows of scales from upper end of gill opening to base of caudal fin 95–104 (Red Sea specimens; those from Gulf of Oman and Persian Gulf with 109–115 rows); snout anterior to nostrils largely naked; gill rakers 6–8 + 13–15 (rarely 13); teeth on side of lower jaw in three to five rows; depth of body 2.7–3.0 in SL; head length 2.4–2.55 in SL; snout length 3.7–4.6 in head; maxilla extending well beyond orbit, the upper jaw length 1.95–

2.1 in head; interorbital space flat; middle opercular spine closer to lower than upper spine; dorsal margin of opercular membrane very convex; ventral margin of preopercle fleshy; margins of subopercle and interopercle partially serrate; longest dorsal spine 2.6–3.1 in head; tips of posterior dorsal and anal rays extending posterior to base of caudal fin; longest dorsal soft ray 2.05–2.35 in head; caudal fin rounded; pectoral fins relatively long and somewhat pointed, 1.35–1.6 in head; pelvic fins nearly or just reaching anus, 1.6–2.0 in head.

COLOR WHEN FRESH. Dark brown to red (depending on depth of water, the deeper individuals red) with dark-edged bright blue spots on head (much more numerous on lower half) and lower half of body, those on thorax largest. Caudal fin and soft portions of dorsal and anal fins darker brown than body, with small dark-edged blue spots (only posteriorly on dorsal fin) and a posterior bluish white margin; distal part of spinous portion of dorsal fin red-orange; pectoral fin brown to reddish brown, with a few small dark-edged blue spots at base, the posterior margin broadly yellow; pelvic fins brown to reddish brown, the rays darker than membranes; iris brown with a narrow inner and outer rings of bright red. Two different color phases may be seen in life on individual fish. The salient marking for one of these phases is a large pale yellowish area dorsally on the body from approximately the posterior end of the pectoral fin to the caudal fin base. The other phase consists of alternating dark and light brown irregular bars on the body and large blotches on the head (these markings more evident dorsally).

Remarks.—The above diagnosis is based on 14 Bishop Museum specimens from the Red Sea, one from the Gulf of Oman, and two from the Persian Gulf. A Red Sea specimen from the British Museum (Natural History) was also examined, as were two from Ain Shams University in Cairo. Measurement data were taken from 14 of these specimens, 110–202 mm SL.

C. hemistiktos appears to be endemic to the seas which border the Arabian Peninsula. It is a coral reef species which occurs throughout the Red Sea where it is the most abundant member of the genus *Cephalopholis*. The senior author noted that it was common at islets in the Gulf of Tadjoura off Djibouti and photographed several underwater which were typical of the Red Sea form. Playfair and Günther (1867) recorded it from Aden (Boulenger, 1895, erroneously listed their locality as Zanzibar). The senior author speared a specimen in shallow water off Mutrah, Oman (BPBM 21326, 99 mm SL) and purchased two from the market in Bahrain (BPBM 21270, 100–202 mm SL) which represent the first records from the Gulf of Oman and Persian Gulf, respectively. The largest specimen of BPBM 21270 was illustrated by Randall et al. (1978). These three specimens are distinct from the Red Sea population in having 18 instead of 17 (occasionally 16) pectoral rays, 109–115 oblique scale rows on the body (instead of 95–104, though the lateral-line pores remain the same), and shorter pectoral fins (1.45–1.6 in head, instead of 1.35–1.45 for Red Sea material). In view of other similarities, particularly of color, the Gulf form is here provisionally regarded as representing the same species. More material should be obtained, particularly from the Gulf of Aden and southern Arabian Peninsula, to see if there is any place where the characters show an abrupt change or if they are clinal around the south part of the peninsula.

Randall (1955) identified an 84-mm grouper from Onotoa, Gilbert Islands (now Kiribati) as *C. hemistiktos* but “with some uncertainty.” A reexamination of this specimen (USNM 167498) revealed its true identity as *C. sonnerati* (Valenciennes).

The record of *C. hemistikos* from Kosi Bay, Natal by Regan (1908) (as *Epinephelus hemistictus*) is also an error (P. C. Heemstra, personal communication).

We have collected specimens of *C. hemistikos* in the Red Sea from depths of 4 to 55 m. As mentioned in the diagnosis, the ground color in shallow water is dark brown. At a depth of 15 m the color is more red than brown; at 30 m or more it is entirely red.

C. hemistikos is a small species. Rüppell (1830) stated that it grows to 8 inches, and Boulenger gave essentially the same total length (200 mm). This seems approximately correct for the Red Sea population, but the Persian Gulf form appears to attain larger size; one of the two specimens collected measures 202 mm SL and 251 mm total length (254 mm when fresh).

Kossmann and Räuber (1877) regarded *hemistikos* as a variety of *C. miniata* based on Red Sea material. As indicated in the Key and Diagnoses, *hemistikos* is readily distinguished from this species.

The lectotype of *Serranus hemistikos* (SMF 314, 146 mm SL) is in the Senckenberg Museum, Frankfurt, along with two paralectotypes (SMF 4899, 123 mm SL; SMF 4896, 105 mm SL). Another paralectotype [BM(NH) 1860.11.9.96, 144 mm SL] is in the British Museum (Natural History).

Cephalopholis miniata (Forsskål)

Plate IC

Perca miniata Forsskål, 1775: 41 (type locality, Jeddah and Lohaja).

Pomacentrus burdi Lacepède, 1802: 511 (type locality, Red Sea).

Serranus cyanostigmatoides Bleeker, 1849: 31 (type locality, Batavia).

Cephalopholis maculatus Seale and Bean, 1907: 235, fig. 5 (type locality, Zamboanga, Philippines).

Cephalopholis formosanus Tanaka, 1911: 24, pl. 7, fig. 22 (type locality, Keelung, Taiwan).

Cephalopholis boninius Jordan and Thompson, 1914: 248, pl. 29, fig. 1 (type locality, Bonin Islands).

Diagnosis.—Dorsal rays IX,15 (one of 11 with 14); anal rays III,9; pectoral rays 17 or 18; lateral-line scales 47–54; oblique rows of scales from upper end of gill opening to base of caudal fin 99–114; snout anterior to nostrils naked; gill rakers 7–9 + 14–15; teeth on side of lower jaw in about four rows; depth of body 2.7–3.05 in SL; head length 2.4–2.6 in SL; snout length 3.6–4.0 in head; maxilla usually extending beyond eye occasionally to below posterior edge of orbit and rarely falling short of this edge; upper jaw length 1.95–2.25 in head; interorbital space slightly convex; middle opercular spine closer to lower than upper spine; dorsal margin of opercular membrane very convex; posterior margin of preopercle serrate; ventral margin of preopercle fleshy, not serrate; margin of subopercle and interopercle serrate; longest dorsal spine 3.3–3.5 in head; longest dorsal soft ray 2.2–2.65 in head; distal ends of posterior rays of dorsal fin not reaching or just reaching a vertical at base of caudal fin; caudal fin rounded; pectoral fins rounded to slightly pointed, 1.5–1.7 in head; pelvic fins not reaching anus, 1.9–2.3 in head.

COLOR WHEN FRESH. Orange-red to reddish brown with numerous blue spots (usually faintly dark-edged) smaller than pupil of eye on body, head, and median fins (spots dark brown in alcohol); anterior part of soft portion of dorsal and anal fins with a blue margin and dark submarginal line; posterior edge of caudal fin with a similar margin (sometimes poorly developed centrally in fin) which becomes submarginal as it approaches corners of fin; pectoral fins orange-red, becoming yellow-orange distally, with only a few blue spots at base; pelvic fins orange-red with a light blue lateral margin distal to spine, often with two or three longitudinal blue streaks. In life one often sees a color phase with diagonal pale olivaceous

bars narrower than brownish red interspaces. The young may be yellow, the blue spots faint.

Remarks.—The above diagnosis is based on 10 Bishop Museum specimens (seven from the Red Sea and three from the western Pacific) and four Seychelles specimens in the Academy of Natural Sciences of Philadelphia. Proportional measurements were taken on all of these specimens which range from 150–250 mm SL.

C. miniata is known from the northern Red Sea south to the Natal coast of South Africa (Smith, 1953; P. C. Heemstra, personal communication confirmed that the J. L. B. Smith Institute of Ichthyology of Rhodes University has specimens of *miniata* from Durban) and east to the Samoa Islands and Marshall Islands (Schultz and collaborators, 1953). Boulenger (1895) examined specimens from Zanzibar, Mauritius, Sri Lanka, Madras, Andaman Islands, Sulawesi (Celebes), Ambon, Kiribati (Gilbert Islands), and Samoa Islands. Sauvage (1891) recorded it from Madagascar. In the western Pacific the species ranges from southern Japan (Kamohara, 1957; Katayama, 1960) to the southern Great Barrier Reef (Marshall, 1964). In addition to the Red Sea, the Bishop Museum has specimens from the Solomon Islands (reported by Seale, 1906), New Guinea (the species first recorded from this locality by Macleay, 1883), Philippine Islands, Ryukyu Islands, Guam, and Fanning Island, Line Islands.

This grouper is generally found on well-developed coral reefs in relatively shallow, clear water. Bishop Museum specimens were collected in the depth range of 2–48 m.

Although reported to grow to 18 inches (460 mm) total length by Smith (1953), Marshall (1964) and Grant (1978), this is considerably larger than any observed by the authors. The largest of 21 specimens in the Bishop Museum measures 264 mm SL and 326 mm total length. Boulenger (1895), however, recorded the maximum total length as 410 mm.

We follow Kamohara (1957) and Katayama (1960) in listing *Cephalopholis formosanus* Tanaka as a junior synonym of *C. miniata*. Fourmanoir and Laboute (1976) were in error using the name *C. formosanus* for the Pacific form of *C. sonnerati* (Valenciennes).

The holotype of *Perca miniata*, ZMC P-43567, 225 mm SL, is in the Zoological Museum of Copenhagen (Klausewitz and Nielsen, 1965: 17, pl. 9, figs. 20).

Cephalopholis oligosticta new species Plate ID and Table 1

Holotype.—BPBM 19709, 172.4 mm SL, ripe female, Red Sea, Sudan, south side of entrance to Port Sudan about 100 m from end of jetty, rock outcrop on sloping silt bottom off fringing reef, 40 m, rotenone, J. E. Randall, 2 October 1975.

Paratypes.—NMW 39259, 215 mm SL, Red Sea, received in Vienna 1837; HUI 10440, 235 mm SL, Eritrea (Ethiopia), Dahlak Island, hook and line, A. Ben-Tuvia, 15 March 1962; SMF 8618, 207 mm SL, Red Sea, Farasan Islands, Sarso Island, 1964 "Meteor" Expedition, W. Klausewitz, 3 December 1964; BPBM 20401, 216.1 mm SL, Sudan, Port Sudan market, J. E. Randall, 15 October 1974; CAS 47921, 172.0 mm SL, and RUSI 513, 194.2 mm SL, same data as preceding; HUI 10543, 188.8 mm SL, Sudan, Port Sudan market, J. E. Randall, 2 October 1975; BPBM 20837, 197.2 mm SL, Red Sea, Gulf of Aqaba, Eilat, off desalination plant, dead reef in 43 m, spear, J. E. Randall, 6 August 1976; BM(NH) 1981.4.6.1, 162 mm SL, same locality as preceding, 24.5 m, spear, J. E. Randall, 7 August 1976; MNHN 1981-720, 173.4 mm SL, Saudi Arabia, Jeddah market, J. E. Randall, 3–7 April 1977; USNM 226618, 187.5 mm SL, same data as preceding.

Diagnosis.—Dorsal rays IX,15; anal rays III,9; pectoral rays 16–18; lateral-line scales 60–71; oblique scale rows from upper end of gill opening to base of caudal fin 107–123; gill rakers 7–8 + 14–15; preopercular margin completely serrate;

Table 1. Proportional measurements of type specimens of *Cephalopholis oligosticta* expressed as a percentage of the standard length

Measurement	Holotype BPBM 19709	Paratypes								
		BM(NH) 1981.4.6.1	CAS 47921	MNHN 1981-720	USNM 226618	HUJ 10543	RUSI 513	BPBM 20837	BPBM 20401	
Standard length (mm)	172.4	162.0	172.0	173.4	187.5	188.8	194.2	197.2	216.1	
Depth of body	37.3	38.1	33.6	35.7	36.3	35.8	33.5	36.2	37.9	
Width of body	17.4	18.0	16.6	15.8	17.3	15.3	15.9	17.3	16.3	
Head length	40.3	39.8	39.6	39.2	39.5	40.9	39.2	38.7	38.6	
Snout length	10.0	9.9	10.4	10.6	10.6	10.6	9.8	10.2	10.2	
Orbit diameter	7.0	6.8	6.7	6.8	6.3	6.5	6.6	6.5	5.9	
Interorbital width	4.8	4.9	5.3	4.8	4.8	5.3	4.7	4.8	4.9	
Length of upper jaw	19.6	20.2	20.6	19.5	19.7	19.6	19.1	19.0	19.2	
Depth of caudal peduncle	13.0	13.2	13.2	13.4	13.8	13.2	12.8	12.8	14.2	
Length of caudal peduncle	16.0	15.6	15.3	15.2	15.2	15.8	15.3	15.9	15.4	
Predorsal length	41.8	42.0	41.3	41.7	42.3	42.2	41.3	41.6	40.7	
Preanal length	66.8	67.7	68.0	67.7	68.0	66.3	67.8	66.0	65.9	
Prepelvic length	39.9	40.0	39.0	40.8	38.6	40.0	38.5	38.3	37.9	
Length of first dorsal spine	6.7	6.9	6.4	6.4	6.3	6.8	6.3	6.4	6.7	
Length of second dorsal spine	10.5	11.4	11.5	10.7	11.2	10.9	11.1	10.8	10.4	
Length of third dorsal spine	12.3	13.3	12.3	11.9	12.5	12.4	12.7	12.1	11.8	
Length of longest dorsal spine	12.8	13.7	12.5	12.8	13.1	13.1	13.3	13.2	12.8	
Length of ninth dorsal spine	11.8	12.6	12.2	12.7	12.8	12.3	12.2	11.7	11.8	
Length of longest dorsal ray	18.7	19.1	18.4	17.9	18.5	18.0	18.0	18.5	18.5	
Length of dorsal fin base	55.0	55.5	55.7	55.2	54.2	55.1	54.6	55.3	57.5	
Length of first anal spine	7.7	7.5	7.7	7.6	7.6	7.7	7.9	7.5	7.8	
Length of second anal spine	14.0	14.6	14.5	13.6	abnormal	15.4	14.8	13.9	13.9	
Length of third anal spine	13.9	14.5	13.9	13.6	14.2	14.9	14.0	13.7	13.7	
Length of longest anal ray	21.0	21.6	19.8	20.5	20.4	20.3	19.5	18.9	19.0	
Length of anal fin base	20.4	18.8	19.7	18.0	19.8	19.2	19.5	20.6	21.7	
Length of caudal fin	25.3	25.6	23.8	24.7	24.5	25.2	23.7	23.7	24.0	
Length of pectoral fin	26.6	28.9	25.2	26.1	26.7	27.1	25.8	26.4	25.6	
Length of pelvic spine	12.9	14.1	12.4	13.5	11.9	13.0	11.8	11.4	11.1	
Length of pelvic fin	23.1	24.7	20.4	20.9	21.7	22.2	21.8	21.5	21.5	

depth of body 2.6–3.0 in SL; head length 2.45–2.6 in SL; caudal fin rounded; pectoral fins 1.4–1.55 in head; pelvic fins relatively long, 1.6–1.95 in head; orange-red in life with a few scattered light blue spots on head, body, and fins (there may be short blue bands on head in addition to spots).

Description.—Dorsal rays IX,15 (last branched to base); anal rays III,9 (last branched to base); pectoral rays 17 (16–18, usually 17; uppermost short and unbranched); pelvic rays I,5; principal caudal rays 17 (upper and lower unbranched); upper and lower procurent caudal rays 8 or 9; lateral-line scales 68 (60–71 plus about 3 pored scales posterior to caudal fin base); oblique scale rows from upper end of gill opening to base of caudal fin 117 (107–123); scales above lateral line to origin of dorsal fin 23 (22–23); scales below lateral line to origin of anal fin 42 (39–43); circumpeduncular scales 52 (52–54); gill rakers 7 + 15 (7–8 + 14–15); pseudobranchial filaments 69 (59–67 for three paratypes); branchiostegal rays 7; predorsal bones 2; vertebrae 10 + 14.

Body moderately deep, the depth 2.7 (2.6–3.0) in SL and somewhat compressed, the width 2.15 (2.2–2.7) in depth; head length 2.5 (2.45–2.6) in SL; snout 4.05 (3.7–4.0) in head; orbit diameter 5.75 (5.75–6.55) in head; interorbital space nearly flat, the least width 8.4 (7.45–8.4) in head; least depth of preorbital one-half to two-thirds orbit diameter; caudal peduncle deeper than long, the least depth 3.1 (2.7–3.1) in head.

Mouth large, oblique, the lower jaw projecting, the maxilla extending well beyond a vertical at posterior edge of orbit, the upper jaw length 2.05 (1.9–2.1) in head; maximum height of maxilla nearly equal to orbit diameter; posterior edge of maxilla rounded to slightly pointed; upper lip covering lower fourth of maxilla posteriorly; supramaxilla present (maximum height on holotype, 1.5 mm); premaxilla protractile for a distance about equal to width of upper lip; front of jaws with a pair of well-separated, slightly recurved, canine teeth, the lowers medial to the uppers; side of jaws with a row of well-spaced, slender, fixed, conical teeth, the uppers larger and more erect than lowers; medial to this a band of depressible villiform teeth which are progressively larger medially (bands broader anteriorly, the uppers without longer medial teeth posteriorly); teeth on side of lower jaw in three rows, reducing to two rows posteriorly; vomer with a V-shaped band of villiform teeth; palatines with a band of villiform teeth; tongue slender, the tip rounded, nearly reaching the most medial teeth at front of lower jaw, the upper surface finely papillate; gill membranes free from isthmus; longest gill raker at angle, about half orbit diameter; nostrils small, anterior to center of eye, the anterior in a membranous tube with an elevated posterior flap, the posterior round, without a rim, separated from orbit by a distance nearly equal to twice internarial space.

Three flat spines posteriorly on opercle, the two upper ones subequal, slightly longer than lower; central opercular spine the most posterior and nearer to lower than upper spine; preopercular margin with a slight indentation above the broadly rounded corner; upper margin of preopercle very finely serrate, the rounded corner and lower margin more coarsely serrate; margins of subopercle and interopercle completely serrate.

Lateral line arched above pectoral region, highest below base of fifth dorsal spine, curving downward to straight midlateral part on caudal peduncle.

Scales cycloid on head, nape, thorax and ventrally on abdomen, ctenoid elsewhere; head entirely scaled except edge of opercular membrane, gill membranes, and a narrow zone on side of snout (enclosing nostrils) from orbit to edge of upper lip; scales on maxilla, lips, and front of snout extremely small and embedded;

scales on opercle larger than rest of head; auxiliary scales on head, none on body; small scales on median fins extending about three-fourths distance to distal margin; scales on paired fins reaching about two-thirds distance to margin (farther out on rays than membranes); medial surfaces of paired fins naked.

Origin of dorsal fin over fourth lateral-line scale, slightly anterior to most posterior point of opercular flap; first dorsal spine slightly more than half length of second spine, 6.0 (5.75–6.25) in head; fourth to seventh dorsal spines subequal, the longest 3.15 (2.9–3.15) in head; ninth dorsal spine 3.4 (3.1–3.35) in head; ninth to eleventh dorsal soft rays longest, 2.15 (2.1–2.25) in head; distal ends of posterior dorsal rays usually reaching a vertical through caudal fin base or extending slightly beyond it; origin of anal fin below base of first dorsal soft ray; first anal spine 5.25 (4.95–5.3) in head; second anal spine stout, 2.9 (2.75–2.9) in head; third anal spine equal in length or slightly shorter than second anal spine; fourth or fifth anal soft rays longest, 1.9 (1.85–2.05) in head; distal ends of posterior anal rays not reaching or just reaching a vertical through caudal fin base; caudal fin rounded, 1.6 (1.55–1.65) in head; pectoral fins slightly pointed, the middle rays longest, 1.5 (1.4–1.55) in head; origin of pelvic fins slightly anterior to base of pectoral fins, the second ray longest, 1.75 (1.6–1.95) in head, nearly or just reaching anus.

COLOR OF HOLOTYPE IN ALCOHOL. Body light brown, paler ventrally, with a few scattered small brown spots (most evident anterodorsally); head light brown with dark brown spots and short bands, those dorsally tending to form rows, one middorsal, one to each side of interorbital space and along side of nape, and one on side of snout, continuing behind eye to dorsal end of gill opening; dorsal and anal fins slightly dusky, the outer triangular part of each interspinous membrane of dorsal fin and first two interspinous membranes of anal fin pale except distal tips which are blackish; soft portion of these fins with about five or six dark spots; margin of these fins dark except posteriorly; caudal fin slightly dusky, the posterior border a little darker, with scattered dark spots; pectoral fins pale; pelvic fins slightly dusky; inside of mouth, gill cavity and peritoneum pale.

COLOR WHEN FRESH. As shown in Pl. ID, orange-red, a little dusky dorsally (centers of scales dusky olive), the dark markings described above light blue; opercular membrane between first two opercular spines deeper red than rest of opercle; pectoral fins with only three faint light blue spots basally; pelvic fins with three longitudinal light blue streaks in addition to a faint blue lateral margin distal to spine.

The paratype HUJ 10543 (and to a lesser extent CAS 47921) is unusual in having darker and more numerous spots; on the body most of the spots fall into $5\frac{1}{2}$ rows; the first is a continuation of a row on the head from snout just over eye and along side of nape; the second follows the anterior two-thirds of the lateral line and passes onto dorsal part of caudal peduncle; below the second row is an irregular half row extending to about end of pectoral fin; remaining rows are on the ventral half of the body; on the head there is a row of spots middorsally, which continues into basal part of dorsal fin, and two diagonal rows of dashes, one across cheek from eye towards corner of preopercle and one from above maxilla to thorax.

Remarks.—This species is named *oligosticta* from the Greek *oligos* meaning few and *stiktos* for spotted, in reference to the widely scattered blue spots. The paucity of spots stands in sharp contrast to the numerous blue spots of its apparent closest relative, *Cephalopholis miniata* (Forsskål).

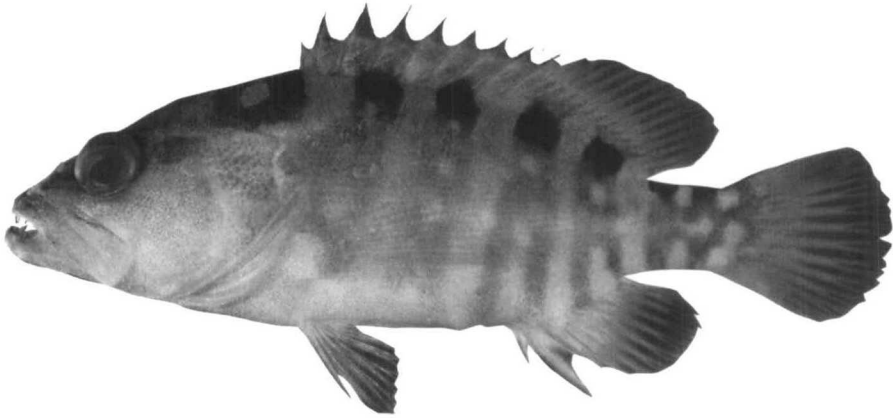


Figure 5. *Cephalopholis sexmaculata*, BPBM 18239, 60.5 mm SL, Gulf of Aqaba.

Apart from the difference in density of spots, *C. oligosticta* may be separated from *miniata* by having more lateral-line scales (60–71 compared to 47–54 for *miniata*), longer pelvic fins (1.6–1.95 in head, compared to 1.95–2.3 for *miniata*), and a serrate ventral preopercular margin.

C. oligosticta has been found only in the Red Sea. We have specimens from off Eilat in the Gulf of Aqaba in the northern part of the sea to the Farasan Islands in the south.

W. Klausewitz (personal communication) reported a specimen of this grouper at the Senckenberg Museum, Frankfurt (SMF 16287, 221.2 mm SL) with an unlikely locality. The label reads "Egypt, Nile, Dr. E. Bannwarth leg. 1913." Probably the specimen was transported from the Red Sea. Extensive descriptive data on the specimen provided by H. Zetzsche leaves no doubt of the identification as *C. oligosticta*. In view of the questionable locality, however, this fish is not designated as a paratype.

This species has been taken in the depth range of 24.5–43 m. It seems to prefer a dead reef environment with silty bottom and somewhat turbid water. It is not common, even in this habitat.

The 162-mm paratype was found with the well-digested remains of an apogonid fish in its mouth which had apparently been regurgitated when the grouper was brought from the depth of 24.5 m where it was speared.

The 172.4-mm holotype and 197.2-mm paratypes are ripe females. The largest paratype, 216.1 mm SL, is a mature male. This specimen is darker than any of the others.

Cephalopholis sexmaculata (Rüppell)

Figure 5, Plate IB

Serranus sexmaculatus Rüppell, 1830: 107 (type locality, Red Sea).

Cephalopholis coatesi Whitley, 1937: 124, pl. XII (type locality, Slasher's Reef, Townsville, Queensland).

Diagnosis.—Dorsal rays IX, 14–15 (usually 15); anal rays III, 9; pectoral rays usually 17 (one of 20 counts was 16 and two were 18); lateral-line scales 49–56; oblique rows of scales from upper end of gill opening to base of caudal fin 100–108; snout naked except for a few scales extending anteriorly from suborbital

region; gill rakers 7–8 + 14–16; depth of body 2.65–3.05 in SL; teeth along side of lower jaw mainly in three rows; head length 2.35–2.45 in SL; snout length 3.7–4.15 in head; maxilla extending well beyond orbit, the upper jaw length 1.95–2.05 in head; interorbital space slightly convex; middle opercular spine closer to lower than upper spine; dorsal margin of opercular membrane very convex; ventral margin of preopercle fleshy, not serrate; margins of subopercle and interopercle partially serrate; longest dorsal spine 2.95–3.2 in head; longest dorsal soft ray 2.3–2.55 in head; distal tips of posterior dorsal rays reaching slightly posterior to base of caudal fin; caudal fin rounded; pectoral fins rounded to slightly pointed, 1.45–1.6 in head; pelvic fins not reaching anus, 2.0–2.25 in head.

COLOR WHEN FRESH. Orange-red with numerous small blue spots on body and head (there may be short blue lines extending anteriorly and posteriorly from orbit), four squarish blackish spots on back which extend into basal part of dorsal fin, and two saddle-like blackish spots dorsally on caudal peduncle, the anterior one twice as large as the posterior (faint dark double bars may extend ventrally from the four squarish dark blotches on back, and single bars from each of the spots dorsally on caudal peduncle); median fins orange-red with small blue spots; pectoral fins yellow-orange, more color in rays than membranes, sometimes with a few small blue spots basally; pelvic fins orange-red.

Remarks.—The above diagnosis is based on 10 Bishop Museum specimens (measurement data on seven of these, 134–269 mm SL), of which five are from the Red Sea, two from Belau (Palau Islands), one from the Caroline Islands, and two from the Marshall Islands.

C. sexmaculata is widespread in the tropical Indo-West-Pacific from the Red Sea and East Africa to French Polynesia, but it is not well represented in museum collections. Günther (1873) listed it from the Society Islands and Tuamotu Archipelago (as *Serranus sexmaculatus*). Boulenger (1895) recorded it from the Red Sea (type locality), Zanzibar, Mauritius, and Tahiti (as *Epinephelus sexmaculatus*). Fowler and Bean (1930) reported only a single specimen from the Philippines and one from the East Indies from the vast ALBATROSS collections. Whitley (1937) created a synonym for it when he named *C. coatesi* from Queensland and was followed in the use of this name by Marshall (1964) and Grant (1978); also by Kami et al. (1968) who listed the species from Guam. Kamohara (1959) recorded *C. sexmaculata* from Kochi Prefecture in Japan, Helfman and Randall (1973) from Belau, Lavondès and Randall (1978) from the Marquesas, and Wass (in press) will list it from the Samoa Islands. The Bishop Museum specimens were collected from the depth range of 9 m (in Marquesas) to 137 m (in Guam).

Randall and Brock (1960) opened the stomachs of 48 specimens of *C. sexmaculata* (misidentified as *C. miniata*) collected in the Society Islands; the largest specimen measured 378 mm SL. Half of the stomachs were empty; small fishes dominated the stomach contents of the remaining groupers. These authors stated that this species is a bay and deep-lagoon form; it was the dominant predator on detached sections of coral reef that roll into deeper water from the fringing reef in Papetoai Bay, Moorea. In the Red Sea and Maldives Islands where the senior author has photographed *C. sexmaculata* underwater, it was most often seen in large caves.

The holotype of *Serranus sexmaculatus* (SMF 2994, 255 mm SL) is a dried specimen in the Senckenberg Museum at Frankfurt.

The holotype of *Cephalopholis coatesi* Whitley, QM I.5504, 260 mm SL, was examined in the Queensland Museum.

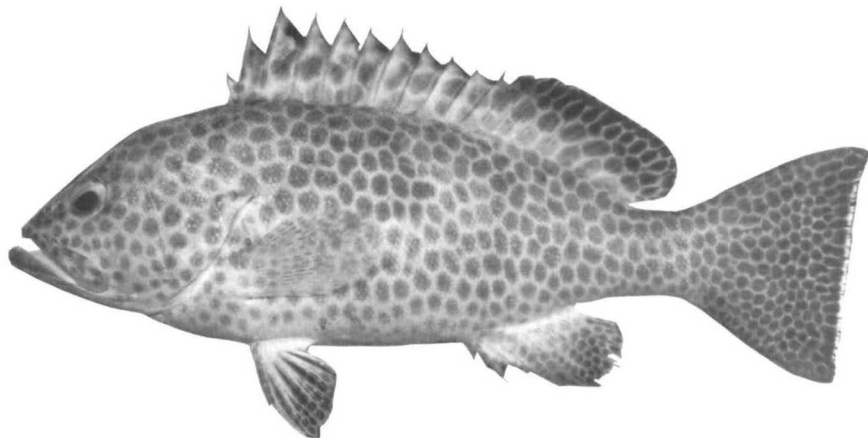


Figure 6. *Epinephelus areolatus*, BPBM 20403, 218 mm SL, Sudan.

Epinephelus areolatus (Forsskål)

Figure 6

Perca areolata Forsskål, 1775: 42 (type locality, Jeddah).

Bodianus melanurus Geoffroy-Saint-Hilaire, 1809: 317, pl. 21, fig. 1 (type locality, Suez).

Serranus angularis Valenciennes in Cuvier and Valenciennes, 1828: 353 (type locality, Ceylon).

Serranus celebicus Bleeker, 1851: 217 (type locality, Bulucomba, Celebes).

Serranus glaucus Day, 1870: 678 (type locality, Andaman Islands).

Epinephelus craspedurus Jordan and Richardson, 1910: 447, fig. 7 (type locality, Kagoshima, Japan).

Diagnosis.—Dorsal rays XI,15–17 (usually 16); anal rays III,8; pectoral rays 17–18 (15 of 23 with 17); lateral-line scales 50–52; oblique rows of scales from upper end of gill opening to base of caudal fin 97–115; head fully scaled except for small region from orbit to nostrils; auxiliary scales present on body; gill rakers 8–9 + 14–16; teeth on side of lower jaw in two rows; depth of body 3.0–3.3 in SL; head length 2.5–2.7 in SL; snout length 3.8–4.2 in head; eye relatively large, the orbit diameter 4.1–5.5 in head; suborbital depth 9.2–11.0 in head; maxilla reaching to a vertical between rear edge of pupil and posterior edge of orbit (on a few specimens just reaching rear edge of orbit), the upper jaw length 2.15–2.25 in head; inter-orbital space slightly convex; middle opercular spine about equidistant to upper and lower spines; opercular flap pointed; dorsal margin of opercular membrane straight; posterior margin of preopercle finely serrate, the prominent rounded corner with 2–5 greatly enlarged serrae; ventral margin of preopercle fleshy; margins of subopercle and interopercle partially serrate; third or fourth dorsal spine usually longest (but fifth nearly as long), 2.5–2.7 in head; longest dorsal soft ray 2.6–2.9 in head; distal ends of posterior dorsal rays approaching but not reaching base of caudal fin; soft portion of anal fin rounded to slightly angular, the third or fourth ray longest, 2.3–2.6 in head; caudal fin of adults emarginate (rarely truncate), the maximum caudal concavity 5 in head; pectoral fins rounded, the middle rays longest, 1.6–1.8 in head; pelvic fins not reaching anus (or rarely just reaching anus), 1.75–2.1 in head.

COLOR WHEN FRESH. Whitish with numerous roundish brown to brownish yellow spots on head (progressively smaller anteriorly) and body except ventrally (largest spots on body of adults approaching size of pupil); dorsal fin with two to three rows of brown spots in spinous portion and three to four in soft; anal, caudal

and pelvic fins with numerous small brown to yellowish brown spots, the caudal with a distinct whitish posterior border (on adults about 2–3 mm broad at widest place); pectoral fins pale or with faint dark spots on rays (Red Sea specimens) or with obvious dark spots on the rays (Indonesian and Pacific specimens); iris light yellow.

Remarks.—The above diagnosis is based on 13 specimens in the Bishop Museum and 10 in the British Museum (Natural History) collected in the Red Sea, Gulf of Oman, Indonesia, and Hong Kong. Measurement data were taken on the 17 largest, 138–305 mm SL.

This species is among the few of the genus with an emarginate caudal fin. The fin on a 71-mm specimen (BPBM 19824), however, is slightly rounded.

E. areolatus is most easily confused with *E. chlorostigma*, also a brown-spotted species with an emarginate caudal fin often bearing a whitish posterior border. *E. chlorostigma* differs in having more numerous and smaller brown spots than *areolatus* when the same size of fishes is compared, modally one more dorsal and one more pectoral ray, an average of two more gill rakers (the mean total gill rakers for *chlorostigma* based on 16 counts is 25.5 whereas that for *areolatus* based on 23 counts is 23.5), a smaller eye over the same size range, a more angular anal fin, shorter pectoral fins on the average, and larger maximum size. In addition, Katayama (1960) has shown that *areolatus* has a deeper caudal peduncle and fewer pyloric caeca (11–17 compared to 26–30 for *chlorostigma*).

A number of authors have misidentified *E. chlorostigma* as *areolatus*, including Valenciennes in Cuvier and Valenciennes (1828), Günther (1859), Playfair and Günther (1867), Day (1875: 12, pl. 1, fig. 4), Sauvage (1891), and Smith (1953: 197, pl. 18, fig. 446). Boulenger (1895), who examined specimens of *E. areolatus* from the Red Sea, Aden, Muscat, Andaman Islands, Malay Archipelago, and Ambon, correctly distinguished the two species.

Other significant Indian Ocean records include India and Sri Lanka (Day, 1875: 22, pl. 5, fig. 3, as *Serranus angularis*), Persian Gulf (Blegvad, 1944), and Andaman Islands and Laccadive Islands (Kyushin et al., 1977). In the western Pacific the species ranges from southern Japan (Temminck and Schlegel, 1842) to northern Queensland (Marshall, 1964: 155, col. pl. 13, fig. 168). It is not known from oceanic islands of the Pacific.

Baissac (1976) listed *E. areolatus* from Mauritius; however, two specimens collected by him at this island now in the J. L. B. Smith Institute of Ichthyology (RUSI 1365, 113–129 mm SL) are not this species (correct identification presently uncertain). Extensive fish collecting at Mauritius by the senior author failed to yield any specimens of this grouper.

E. areolatus is generally found in somewhat turbid water in grass beds or silty sand bottoms around isolated small rock outcrops, dead coral or soft coral. Bishop Museum specimens were taken in the depth range of 6 to 18 m. Fowler and Bean (1930) recorded Philippine specimens to 57 fathoms (=104 m). Fourmanoir and Laboute (1976: 56) recorded it from 10–200 m at New Caledonia and noted that the stomachs often contain penaeid shrimps. Their illustration from an underwater photo exhibits a barred pattern on the body from vertical zones where the spots are alternately darker and lighter. They give a maximum length of 450 mm.

The holotype of *E. areolatus*, ZMC P-43570, 280 mm SL, is in the Zoological Museum of Copenhagen (Klausewitz and Nielsen, 1965: 18, fig. 23).

Two syntypes of *Serranus angularis* Valenciennes (MNHN 7280, 235–279 mm SL) from Sri Lanka were examined for us by Phillip C. Heemstra when visiting the Muséum National d'Histoire Naturelle in Paris. From data given by him on

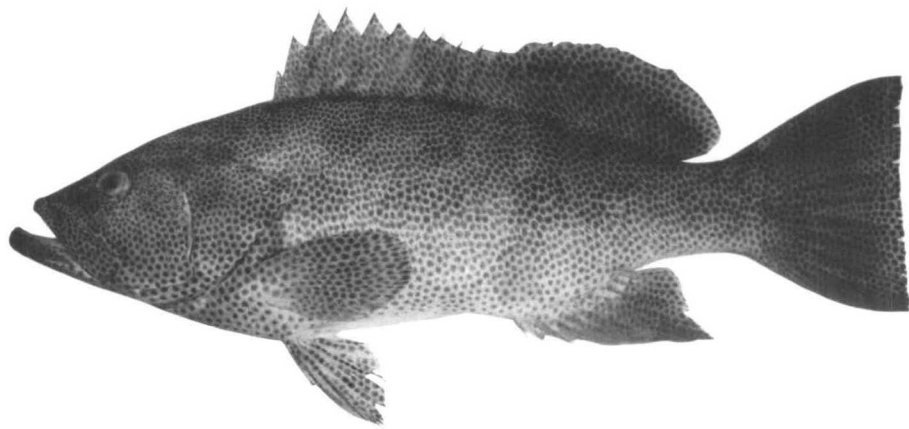


Figure 7. *Epinephelus chlorostigma*, BPBM 18207, 406 mm SL, Sinai Peninsula.

such things as color pattern and number of lower-limb gill rakers (14 for both specimens) it is clear that these fish are examples of *E. areolatus*. Some other authors, such as Boulenger (1895) and Weber and de Beaufort (1931), had already reached this conclusion.

Epinephelus chlorostigma (Valenciennes)

Figure 7

Serranus chlorostigma Valenciennes in Cuvier and Valenciennes, 1828: 352 (type locality, Seychelles).

?*Serranus areolatus japonicus* Temminck and Schlegel, 1842: 8 (type locality, Japan).

Serranus reevesii Richardson, 1846: 232 (type locality, Canton, Sea of China).

Serranus Waandersii Bleeker, 1858–1859: 152 (type locality, Boeleng, Bali).

Serranus Geoffroyi Klunzinger, 1870: 675, footnote (type locality, Suez).

Serranus celebicus var. *multipunctatus* Kossmann and Räuber, 1877: 6 (type locality, Red Sea).

Serranus (Hyposerranus) Geoffroyi Klunzinger, 1884: 3.

Serranus assabensis Giglioli, 1888: 68 (type locality, Assab, Ethiopia).

Diagnosis.—Dorsal rays XI,16–18 (usually 17); anal rays III,8; pectoral rays 17 or 18 (12 of 14 have 18 rays); lateral-line scales 49–53; oblique rows of scales from upper end of gill opening to base of caudal fin 99–119; head fully scaled except for a small zone from orbit to nostrils; auxiliary scales present on body; gill rakers 8–11 + 15–18; teeth on side of lower jaw in two rows; depth of body 2.6–3.3 in SL; head length 2.5–2.7 in SL; snout length 3.4–4.0 in head; front of head decidedly pointed, the lower jaw prominently protruding; orbit diameter 5.0–7.25 in head; suborbital depth 8.0–9.5 in head; maxilla reaching from below center of eye to slightly posterior to hind edge of orbit, the upper jaw length 2.15–2.35 in head; interorbital space slightly convex; middle opercular spine nearer lower than upper spine; opercular flap moderately pointed; the dorsal margin of opercular membrane straight; posterior margin of preopercle serrate, the rounded corner with 4–7 enlarged serrae; ventral margin of preopercle fleshy; margins of subopercle and interopercle partially serrate; third or fourth dorsal spines longest, 2.5–3.2 in head; longest dorsal soft ray (fifth to eighth) 2.55–3.2 in head; distal ends of posterior dorsal soft rays not approaching caudal fin base; soft portion of

anal fin distinctly angular (especially in Red Sea individuals), the third to fifth rays longest, 1.9–2.5 in head; caudal fin usually slightly emarginate, the maximum caudal concavity 6.4 in head (see Remarks regarding Japanese specimens); pectoral fins rounded, the middle rays longest, 1.75–2.0 in head; pelvic fins not reaching (or rarely just reaching) anus, 1.75–2.4 in head.

COLOR WHEN FRESH. Whitish, the head and body with numerous close-set, roundish to hexagonal, brown to dark brown spots, the largest on body of adults about half greatest pupil diameter; a narrow blackish streak at upper edge of maxillary groove; all fins densely spotted with brown, the spots on the pectoral fins confined to rays; posterior border of caudal fin usually white; iris orange-yellow with some brown pigment. The junior author observed an adult individual of *E. chlorostigma* at the south end of the Sinai Peninsula assume a color pattern of three to four rows of large spots.

Remarks.—The diagnosis above is based on the holotype, five specimens from the Bishop Museum, two from which data were taken in the field, and eight from the British Museum (Natural History); these 16 specimens, 144–444 mm SL, were collected in the Red Sea, Gulf of Oman, Persian Gulf, Seychelles, Zanzibar, and Caroline Islands. Measurements were taken on all these specimens.

E. chlorostigma has frequently been misidentified as *E. areolatus* (see Remarks for *areolatus*).

Other localities for which *E. chlorostigma* has been reported are Mozambique (Peters, 1855), India, Sri Lanka and Malay Archipelago (Day, 1875: 12, pl. 1, fig. 4), China Sea (Boulenger, 1895), Madagascar (Sauvage, 1891), Taiwan (Jordan and Evermann, 1902), southern Japan (Jordan and Richardson, 1910: 446, fig. 6), Sulawesi (Celebes) (Fowler and Bean, 1930), Philippines (Elera, 1895—reference from Fowler and Bean, 1930), Natal (Smith, 1953: 197, pl. 18, fig. 446), Mauritius (Baissac, 1976), New Caledonia (Fourmanoir and Laboute, 1976: 33, 56), and the Andaman Islands, Nicobar Islands, Laccadive Islands, and Chagos Archipelago (Kyushin et al., 1977). A specimen (BPBM 24617, 374 mm SL) from Sonsoral Islands, western Caroline Islands, just south of Belau at 5°N, represents the first record from Micronesia.

E. chlorostigma occurs over a wide range of depth and habitat. The senior author speared an adult at A-Tur, Gulf of Suez, in 4 m; Fourmanoir and Laboute (1976) reported it from New Caledonia in 150–280 m. Their largest was 750 mm total length and weighed 7 kg.

The holotype of *Serranus chlorostigma* Valenciennes (MNHN 7430: 189 mm SL) was kindly sent on loan to the senior author by Martine Desoutter of the Muséum National d'Histoire Naturelle, Paris.

Boeseman (1947) concluded that *Serranus areolatus japonicus* Temminck and Schlegel is a junior synonym of *E. chlorostigma*. The type (RMNH D76, 270 mm SL) is a dried, stuffed specimen at the Rijksmuseum van Natuurlijke Historie in Leiden. It appears to be typical of *chlorostigma* except for a slightly rounded caudal fin (this shape given in original description and confirmed by Boeseman, personal communication). Katayama (1960: 71, pl. 9) described the caudal shape of his specimens as truncate, but his illustration shows the fin slightly rounded. Masuda et al. (1975: pl. 46D) figured a Japanese specimen with truncate caudal fin. Perhaps *chlorostigma* in Japanese waters differs from the species elsewhere in its range in not having an emarginate caudal fin. More study of this problem seems in order.

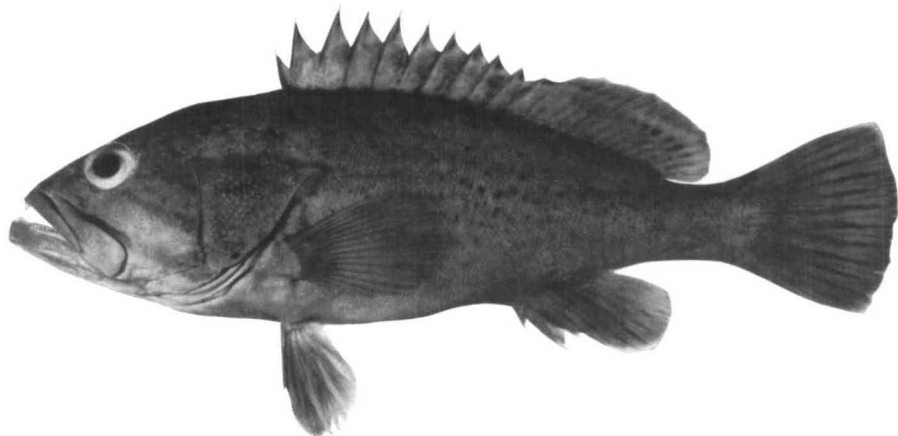


Figure 8. *Epinephelus epistictus*, BPBM 27483, 320 mm SL, Cochin, India.

Epinephelus epistictus (Temminck and Schlegel)
Figure 8

Serranus epistictus Temminck and Schlegel, 1842: 8 (type locality, Japan).

Epinephelus praeopercularis Boulenger, 1887: 654 (type locality, Muscat); 1895: 207, pl. 5.

Diagnosis.—Dorsal rays XI, 14 or 15 (usually 14); anal rays III, 8; pectoral rays 17 or 18 (one of 20 specimens with 19 on one side); pored lateral-line scales 57–66; oblique rows of scales from upper end of gill opening to caudal base 105–117; head scaled except for a zone from orbit to edge of upper lip containing nostrils; scales on head, nape and anterodorsally on body cycloid, ctenoid on rest of body; no scales found on maxilla (though Boulenger reported a few scales sometimes present); no auxiliary scales; gill rakers 8–9 + 15–17; teeth on side of lower jaw in two rows; depth of body 2.9–3.3 in SL; width of body 1.8–2.1 in depth; head length 2.3–2.45 in SL; interorbital space slightly convex; eye large, the orbit diameter 4.5–5.75 in head; snout length 3.9–4.4 in head; maxilla not reaching, just reaching, or extending slightly beyond a vertical at rear edge of orbit, the upper jaw length 2.0–2.2 in head; posterior nostril slightly larger than anterior, the anterior with a very broad posterior flap; opercular spines very flat, the prominent middle one most posterior and about equidistant to upper and lower spines or slightly closer to lower (upper and lower spines sometimes difficult to detect); dorsal margin of opercular membrane moderately convex; posterior border of preopercle finely serrate, the serrae larger ventrally, 3 to 5 at the projecting corner greatly enlarged; margins of subopercle and interopercle smooth or with a few feeble serrae; longest dorsal spine (third to fifth) 2.9–3.7 in head; longest dorsal ray (fourth to sixth) 2.55–3.2 in head; posterior dorsal rays not reaching base of caudal fin; caudal fin slightly to moderately rounded; pectoral fin 1.65–2.05 in head; pelvic fins short, 2.15–2.7 in head.

COLOR OF ADULTS WHEN FRESH. Light brown, shading to lavender-brown ventrally, with irregular rows of small dark brown spots on body (spots relatively smaller and less distinct in larger individuals); a faint broad dark band extending from orbit to opercular flap and two narrower diagonal dark bands on cheek, the lowermost passing from edge of maxillary groove to below corner of preopercle;

fins yellowish brown, the corners of the caudal and soft portions of the dorsal and anal with a whitish margin; dorsal fin with an indistinct pale band about three-fourths distance to margin; iris pale yellow. Juveniles with three longitudinal rows of prominent dark brown spots on postorbital head and body.

Remarks.—The above diagnosis is based on seven specimens in the Academy of Natural Sciences of Philadelphia and Bishop Museum from the Red Sea, Gulf of Oman, and off Cochin, India, 12 Gulf of Suez specimens in the Muséum National d'Histoire Naturelle, one specimen from Eritrea in the collection of the Hebrew University, and five specimens from the Gulf of Oman and Hong Kong in the British Museum (Natural History). Measurement data were taken from 14 of these fish, 123–396 mm SL.

The holotype of *Serranus epistictus* (RMNH 88, 230 mm SL) is in the Rijksmuseum van Natuurlijke Historie. Two syntypes of *Epinephelus praeopercularis* were examined in the British Museum (Natural History). BM(NH) 1887.11.11.40, 236.5 mm SL, is here selected as the lectotype.

The first Red Sea record was made by Dor (1970) who reported a juvenile from Eritrea. The species is otherwise known only from the Gulf of Oman, India (BPBM 27483, 320 mm SL), Viet Nam (Fourmanoir, 1965), China (Chan, 1968), and Japan. The record by Barnard (1927) from Natal (as *E. praeopercularis*) is probably *E. magniscuttis* Postel, Fourmanoir and Guézé. A 349-mm Bishop Museum specimen (BPBM 22335) from the Farasan Bank, Red Sea, was taken by trawling in 200 m. A 220-mm specimen (ANSP uncat.) from the Gulf of Oman, was trawled in 290 m.

Boulenger (1895) reported the maximum total length (as *E. praeopercularis*) to be 800 mm.

Some authors have mistakenly regarded *E. epistictus* as the young of *E. latifasciatus*. Katayama (1960) distinguished these two species on several characters, of which the most useful is the number of dorsal soft rays (usually 14 or 15 for *epistictus* and 12 or 13 for *latifasciatus*).

Epinephelus fasciatus (Forsskal)

Figure 9

Perca fasciata Forsskal, 1775: 40 (type locality, Red Sea).

Epinephelus marginalis Bloch, 1793: 14, pl. 328, fig. 1 (type locality, East Indian seas).

Holocentrus erythraeus Bloch and Schneider, 1801: 320 (type locality, Red Sea).

Holocentrus forskael Lacepède, 1802: 337, 377 (substitute name for *Perca fasciata* Forsskal).

Holocentrus marginatus Lacepède, 1802: 384 (error for *marginalis* Bloch).

Holocentrus rosmarus Lacepède, 1802: 345, 389, pl. 7, fig. 2 (type locality, "le grand Océan" = Pacific Ocean).

Holocentrus oceanicus Lacepède, 1802, 345–346, 389, pl. 7, fig. 3 (type locality, "le grand Océan" = Pacific Ocean).

Serranus variolosus Valenciennes in Cuvier and Valenciennes, 1828: 354 (type locality, Tahiti).

Serranus tsurimen-ara Temminck and Schlegel, 1842, pl. 4, fig. 3 (type locality, Japan).

Serranus cruentus De Vis, 1884: 446 (type locality, New Britain).

Serranus geometricus De Vis, 1885 (1884): 144 (type locality, Moreton Bay, Queensland).

Epinephelus zapyrus Seale, 1906: 36, fig. 11 (type locality, Tubuai, Austral Islands).

Epinephelus emoryi Schultz in Schultz and collaborators, 1953: 330, 340, fig. 52 (type locality, Bikini Atoll, Marshall Islands).

Diagnosis.—Dorsal rays XI, 16 or 17 (rarely 17); anal rays III, 8; pectoral rays 18 or 19 (usually 19); lateral-line scales 50–53; oblique rows of scales from upper end of gill opening to caudal fin base 102–113; head fully scaled except for a small area from orbit to nostrils; auxiliary scales present on body; gill rakers 6–8 + 15–17; teeth on side of lower jaw in two to three rows; depth of body 2.9–3.2 in SL;

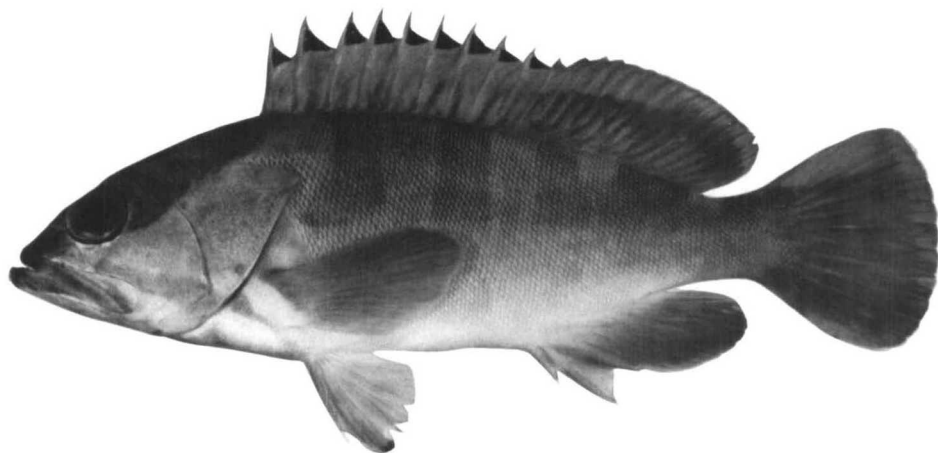


Figure 9. *Epinephelus fasciatus*, BPBM 19868, 151 mm SL, Sinai Peninsula.

head length 2.4–2.65 in SL; snout length 4.3–5.1 in head; maxilla reaching to or posterior to rear edge of orbit, the upper jaw length 2.15–2.3 in head; interorbital space flat; middle opercular spine equidistant to upper and lower spines or slightly closer to lower spine; dorsal margin of opercular membrane slightly convex; posterior margin of preopercle finely to moderately serrate, the ventral margin smooth and membranous; margins of subopercle and interopercle smooth; longest (fourth to seventh subequal) dorsal spine 2.7–3.05 in head; longest dorsal soft ray (fifth to seventh) 2.4–2.7 in head; distal ends of posterior dorsal soft rays not reaching or just reaching a vertical at caudal fin base; caudal fin slightly to moderately rounded; pectoral fins 1.7–1.9 in head; pelvic fins not reaching or just reaching anus, 1.9–2.25 in head.

COLOR WHEN FRESH. Ground color varying from light pinkish gray to pale yellowish red with five dusky to dark orange-red bars on the body (best developed on dorsal half), these bars sometimes containing pale blotches; large dusky to dark reddish blotches middorsally on postorbital head and in a row from behind eye to origin of dorsal fin; a broad orange-red streak from below eye across corner of preopercle and three diagonal red bands on thorax; orbit conspicuously edged in blackish (except anterodorsally) with an outer adjacent ring of light blue; fins pinkish gray to orange-red, with a triangular black area distally on each interspinous membrane except membranous tips which are pink; distal margins of median fins pale whitish to yellowish.

Remarks.—The above diagnosis is based on 16 Red Sea specimens and six specimens from the Indian Ocean and Pacific (including the holotype of *Epinephelus zapyrus* Seale) in the collection of the Bishop Museum. Measurements were made on eight of these specimens ranging from 123–258 mm SL. Counts are recorded above only for the Red Sea specimens. It was noted that the number of pored lateral-line scales and number of scale rows were lower in the Red Sea than other localities.

As might be surmised from the numerous junior synonyms, *E. fasciatus* is a common and wide-ranging grouper. It occurs throughout the Indo-Pacific from the Red Sea and East African coast to Ducie Atoll in the Pitcairn Group (Rehder

and Randall, 1975); it is known from or can be expected from virtually any island of Oceania except the Hawaiian Islands and Easter Island. In the western Indian Ocean it ranges to Port Alfred, South Africa (33.4°S) (Smith, 1953). Kyushin et al. (1977) recorded it from the Andaman Islands, Laccadive Islands, and Chagos Archipelago. In the western Pacific it occurs from southern Japan (Masuda et al., 1975) to southern Queensland (Grant, 1978) and Lord Howe Island (Allen et al., 1976).

E. fasciatus is a species of coral reefs or rocky bottoms. It may be found in relatively shallow water and is known from depths to 160 m (Kyushin et al., 1977).

The stomachs of 21 specimens, 112–240 mm SL, were opened by the senior author for food habit study. Nine of the fish were empty; one contained an alpheid shrimp, three contained crabs (two of which were majids), and eight had eaten fishes (including *Apogon apogonides* and *Pterocaesio tile*).

Boulenger (1895) recorded the total length of this species to 330 mm, and Masuda et al. (1975) to 400 mm.

The type of *Perca fasciata* Forsskål is not extant (Klausewitz and Nielsen, 1965).

Two syntypes of *Serranus geometricus* De Vis, QM I.10140, 235 and 249 mm SL, were examined at the Queensland Museum by the senior author; the largest specimen is selected as the lectotype.

Fowler and Bean (1930) were in error in regarding *Epinephelus retouti* Bleeker as a synonym of *E. fasciatus*. It is a valid, though rare, species known from Réunion (the type locality), Madagascar (Sauvage, 1891) and Mauritius (Baissac, 1976). Although similar in configuration, color (including a dark red to black submarginal triangle on each interspinous membrane of the dorsal fin), and meristic data, it differs from *E. fasciatus* in having broader dark bars on the body, the upper part of the first two bars dark reddish brown to black and extending well into dorsal fin. Also it appears to have higher scale counts. One specimen from Mauritius (BPBM 17348) has 72 pored lateral-line scales and 141 oblique rows of scales between the upper end of the gill opening and the caudal fin base. By contrast, a specimen of *E. fasciatus* (BPBM 20163) from Mauritius has 53 lateral-line scales and 123 scale rows on body. The holotype of *E. retouti* (RMNH 5415, 122 mm SL) was examined at the Rijksmuseum van Natuurlijke Historie at Leiden by the senior author. The species from New Caledonia identified as *E. retouti* by Fourmanoir and Laboute (1976: 62) is *E. truncatus* Katayama.

Epinephelus fuscoguttatus (Forsskål)

Figures 10 and 11

Perca summana var. *fusco-guttata* Forsskål, 1775: 42 (type locality, Suerens and Jeddah).

Serranus horridus Valenciennes in Cuvier and Valenciennes, 1828: 321 (type locality, Java).

Serranus lura Valenciennes in Cuvier and Valenciennes, 1831: 474 (type locality, Mauritius).

Diagnosis.—Dorsal rays XI, 14 or 15 (usually 14); anal rays III, 8; pectoral rays 18–20 (usually 19); pored lateral-line scales 49–58; oblique scale rows from upper end of gill opening to caudal fin base 102–115; head fully scaled except for small area from orbit to nostrils; scales cycloid (ctenoid in juveniles; a specimen 120 mm in SL has lost the ctenii on its scales except on caudal peduncle); auxiliary scales present (infrequent on some specimens); gill rakers 10–12 + 18–21; teeth on side of dentary in three irregular rows; depth of body 2.6–2.9 in SL; head length 2.3–2.4 in SL; dorsal profile of head posterior to interorbital strongly convex; snout 4.0–4.7 in head; maxilla extending posterior to eye by a horizontal distance equal to about one-half to a full orbit diameter, the upper jaw length

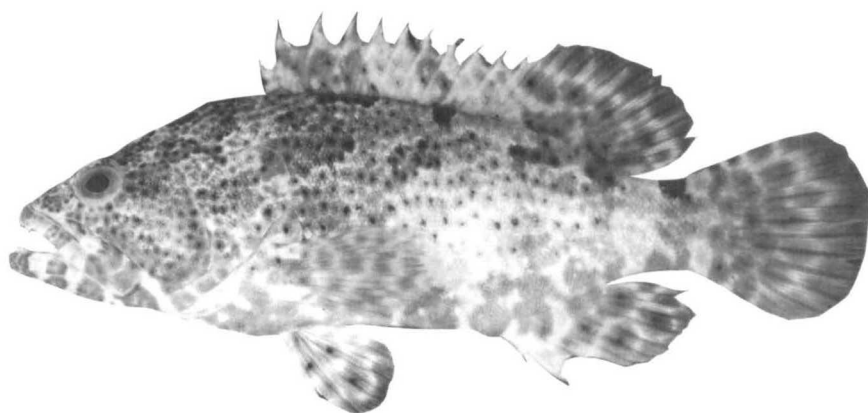


Figure 10. *Epinephelus fuscoguttatus*, BPBM 20705, 88 mm SL, Sudan.

1.8–2.0 in head; interorbital space flat to concave; posterior nostril subtriangular, much larger than anterior; middle opercular spine closer to lower than upper spine; dorsal margin of opercular membrane strongly convex except posterior end which is slightly produced; margin of preopercle rounded, the corner slightly produced; posterior margin of preopercle finely serrate dorsally, the serrae becoming progressively coarser ventrally, though not at corner greatly enlarged (serrae at corner largely covered by skin); margins of subopercle and interopercle smooth; third to fifth dorsal spines longest, subequal, 2.9–3.4 in head; longest dorsal soft ray (fifth to eighth) 2.3–2.95 in head; posterior dorsal and anal rays not reaching or barely reaching a vertical at caudal fin base; caudal fin rounded; pectoral fins 1.9–2.4 in head; pelvic fins not reaching anus, 2.05–2.75 in head.

COLOR WHEN FRESH. Light yellowish brown with large irregular brown patches on head and body, the darkest dorsally (a series of five dark brown blotches on back along base of dorsal fin, often subquadrangular, one below middle of soft portion of fin L-shaped when viewed on right side of fish) which extend diffusely into fin, and a very dark brown, saddle-like, subtriangular spot dorsally on caudal peduncle; head, body, and fins densely covered with small dark brown spots

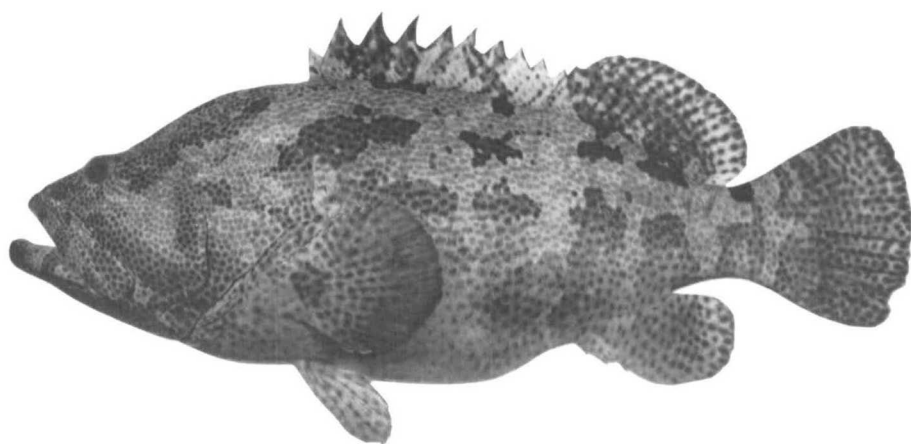


Figure 11. *Epinephelus fuscoguttatus*, 551 mm SL, Saudi Arabia, specimen not saved.

(relatively smaller and more numerous on larger individuals); spots in pectoral fin may be aligned to form curved bands; spots on head smaller than those on body; jaws and chin traversed by pale bands.

Remarks.—The above diagnosis is based on 18 specimens in the Bishop Museum, British Museum (Natural History), California Academy of Sciences, and U.S. National Museum of Natural History from the Red Sea, Zanzibar, and islands of Oceania. Proportional measurements were taken from ten of these measuring 120–551 mm SL.

E. fuscoguttatus has long been confused with the closely related *E. microdon* (Bleeker). Forsskål's description of *fuscoguttatus* (as a variety of *summana*) is not sufficiently detailed to be certain which of the two species he had. Some authors such as Rüppell (1830) have used the name *fuscoguttatus* for the species we here regard as *microdon*, whereas others such as Bleeker (1873–1876) and Day (1875–1878) applied it to the other species. Most authors have not distinguished these two fishes. Randall (1964) clearly differentiated them on pectoral-ray counts (16 or 17 for *microdon*, 18 to 20 for *fuscoguttatus*), lower-limb gill rakers (16 to 18 for *microdon*, 18 to 21 for *fuscoguttatus*, including raker at angle), shape of the dorsal profile of the head (smoothly convex in *microdon*, an indentation above hind edge of eye in *fuscoguttatus*), and body depth (deeper on the average in *fuscoguttatus*).

The holotype of *fuscoguttatus* is not extant. Because Forsskål gave a pectoral count of 18 in his description of this fish, Randall (1964) elected to restrict this name to the species as here diagnosed. He described a neotype (USNM 147594, 216 mm SL) from Jeddah.

Because of the confusion with *microdon* (as well as *E. tukula*—see Remarks under *E. microdon*), it is not possible to sort out all the records of *fuscoguttatus* in the literature. The species does appear to occur in the Red Sea, along the coast of Africa (at least from northern Kenya to Mafia Island, Tanzania, according to Morgans, 1959), Madagascar (Harmelin-Vivien and Bouchon, 1976), Mauritius (type locality of *Serranus lutra*), Seychelles (Smith and Smith, 1963), Laccadive Islands (Jones and Kumaran, 1980), Maldives Islands (underwater photos by the senior author), India (Day, 1875–1878), Indonesia (Bleeker, 1873–1876), Philippines (Fowler and Bean, 1930, in part), southern Japan (Masuda et al., 1975), Queensland (Grant, 1978, in part), New Caledonia (Fourmanoir and Laboute, 1976: small left-hand figure; the other figure is *E. microdon*), Guam (Shepard and Myers, 1981), Marshall Islands (Schultz in Schultz and collaborators, 1953, in part), Kiribati (Gilbert Islands) (Randall, 1955), and the Phoenix Islands (Schultz, 1943, in part). The species is not known from the Hawaiian Islands, French Polynesia, Pitcairn Group, or Easter Island.

Morgans (1959) recorded the largest specimen of *E. fuscoguttatus* from East Africa as 760 mm SL, 885 mm TL and 24 pounds.

Only a few specimens have been examined for food habits (Harmelin-Vivien and Bouchon, 1976; Randall, 1980b). The food consisted of fishes, brachyuran crabs, and cephalopods.

Epinephelus latifasciatus (Temminck and Schlegel)

Figure 12

Serranus latifasciatus Temminck and Schlegel, 1842: 6 (type locality, Japan).

Serranus grammicus Day, 1867: 700 (type locality, Madras).

Priacanthichthys maderaspatensis Day, 1868: 193 (type locality, Madras).

Diagnosis.—Dorsal rays XI, 12 or 13 (one with X, 14); anal rays III, 8 (rarely 7); pectoral rays 18 or 19; pored lateral-line scales 58–61; oblique rows of scales from

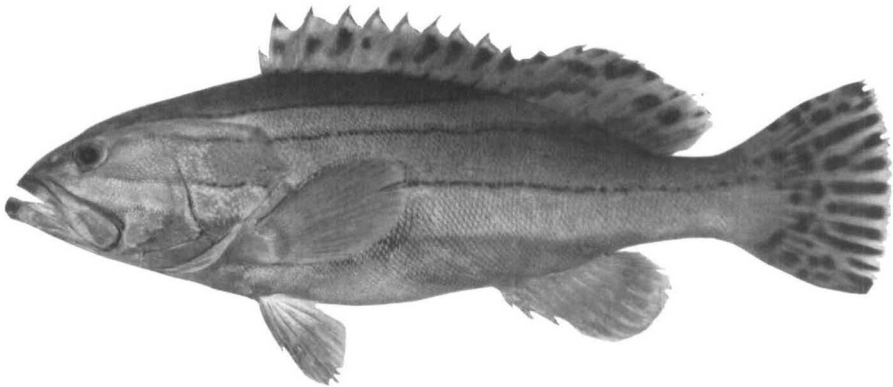


Figure 12. *Epinephelus latifasciatus*, BPBM 23191, 297 mm SL, Taiwan.

upper end of gill opening to caudal base 96–106; head scaled except for a narrow zone from orbit to upper lip containing nostrils; auxiliary scales may be present on head and body of adults; scales cycloid on large adults (small fish may have weakly ctenoid scales anteriorly on side of body); a wedge-shaped patch of tiny scales sometimes present posteriorly on maxilla; gill rakers 8–10 + 15–17; teeth on side of lower jaw in two rows; depth of body 2.9–3.4 in SL; body moderately compressed, the width 1.6–1.85 in depth; head length 2.35–2.55 in SL; interorbital space convex; snout length 4.0–4.7 in head; maxilla extending well posterior to orbit, the upper jaw length 2.05–2.25 in head; nostrils about equal in size, the anterior with a very broad posterior flap; opercular spines very flat, the prominent middle one most posterior and much closer to lower than upper spine (upper and lower opercular spines often not well developed and difficult to detect); upper margin of opercular flap usually convex; posterior margin of preopercle serrate, the serrae very fine dorsally, increasingly coarse ventrally, the projecting rounded corner with 3 to 7 greatly enlarged serrae; lower margin of preopercle and margins of subopercle and interopercle smooth; longest dorsal spine (third to fifth about equal) 3.0–3.8 in head; longest dorsal rays (usually the fourth) 2.3–3.0 in head; posterior dorsal rays not reaching base of caudal fin; caudal fin slightly to moderately rounded; pectoral fins 1.9–2.2 in head; pelvic fins short, 2.2–2.65 in head.

COLOR OF ADULTS WHEN FRESH. Lavender-gray, a little yellowish dorsally on back and head, shading to whitish ventrally, with four longitudinal dark brown lines on head and body, one from upper edge of orbit to rear base of spinous portion of dorsal fin, the second from above center of orbit to middle of soft portion of dorsal fin, the third from lower edge of eye to slightly above middle of caudal fin base (sometimes extending into fin), and the fourth from above maxilla across cheek and lower operculum, beneath upper part of pectoral fin and extending to above rear base of anal fin (this lowest line often faint on adults; on large individuals the lines break into dashes and spots; the lines of smaller individuals are broader and more distinct, the region between the first and second and between the third and fourth paler than rest of head and body which is brown); dorsal and caudal fins light yellowish, spotted with black, the spots on the spinous portion of the dorsal tending to form a median band; margin of spinous portion of dorsal fin black; anal and pelvic fins pale bluish gray; pectoral fins pale yellowish gray.

Remarks.—The above diagnosis is based on the lectotype (RMNH 21, 329 mm SL, designated by Boeseman, 1947) and paralectotype from Japan in the Rijksmuseum van Natuurlijke Historie; nine Bishop Museum specimens from the Red Sea, Persian Gulf, Gulf of Oman, India (both coasts), and Taiwan; two southern Red Sea specimens from the Hebrew University collection; and one specimen from Viet Nam in the Muséum National d'Histoire Naturelle. Measurement data were taken from eight of these specimens, 163–509 mm SL.

The first Red Sea record of *E. latifasciatus* was that of Ben-Tuvia (1968) who reported it from Ethiopia. Dor (1970) followed with a record from Eritrea. The Bishop Museum specimen (BPBM 22336, 509 mm SL) from the Red Sea was taken in 200 m at the Farasan Bank by trawling.

In addition to the localities given above, *E. latifasciatus* has been reported from Shanghai, China (Boulenger, 1895), Hong Kong (Chan, 1968), and Korea (Masuda et al., 1975). It is a continental species, not known from any oceanic islands. Curiously, it has yet to be reported from the east coast of Africa, Sri Lanka, Indonesia, New Guinea, or Australia.

The senior author was present in Cochin, India when a few specimens of this grouper were landed from vessels that were trawling in 20 to 65 m. Chan (1968) stated that the Hong Kong fishing grounds have a depth of less than about 40 fathoms (73.5 m). Large individuals appear to prefer coarse sand or rocky substrata, whereas young fish live also on mud bottoms. This species may be taken by hook and line as well as by trawl.

Boulenger (1895) reported it to 700 mm total length. He and other authors have mistakenly regarded *E. epistictus* (Temminck and Schlegel) as a synonym of *E. latifasciatus*. Katayama (1960) clearly showed that the two species are distinct (see Remarks for *epistictus*).

The species from the Comoro Islands identified as *E. latifasciatus* by Fourmanoir (1957) is *E. morrhua* (Valenciennes).

Epinephelus malabaricus (Bloch and Schneider)

Figures 13 and 14

Holocentrus malabaricus Bloch and Schneider, 1801, p. 319 (type locality, Tranquebariam).

Holocentrus salmoides Lacepède, 1802: 389; illustrated in Lacepède, 1801: pl. 34, fig. 3 (type locality, "le grand Océan" = Pacific Ocean).

Serranus suillus Valenciennes in Cuvier and Valenciennes, 1828: 335 (type locality, coast of Comandell).

Serranus semi-punctatus Valenciennes in Cuvier and Valenciennes, 1828: 341 (type locality, Pondichéry).

Serranus salmonoides Valenciennes in Cuvier and Valenciennes, 1828: 343 (emendation of *Holocentrus salmoides* Lacepède).

Serranus crapao Cuvier in Cuvier and Valenciennes, 1829: 494 (type locality, Batavia).

Serranus polydophilus Bleeker, 1849: 37 (generic name abbreviated as *Serran.*) (type locality, Batavia); Bleeker, 1873–1876: 59, pl. 283, fig. 1.

Serranus estuarius Macleay, 1884: 200 (type locality, Mary River, Queensland).

Diagnosis.—Dorsal rays XI,14–16; anal rays III,8; pectoral rays 19 or 20 (20 of 30 with 19); pored lateral-line scales 58–64; oblique rows of scales between upper end of gill opening and caudal fin base 102–115; scales ctenoid except on head, dorsoanteriorly on body, and on thorax and abdomen where cycloid; head scaled except zone adjacent to anterior edge of orbit; auxiliary scales present; gill rakers 8–11 + 15–18 (modally 16); teeth on side of dentary in two rows; depth of body 3.1–3.6 in SL; body moderately thick, the width just behind gill opening 1.55–1.7 in depth; head length 2.35–2.55 in SL; snout 3.3–4.4 in head (relatively longer in larger individuals); maxilla extending posterior to a vertical at hind edge of

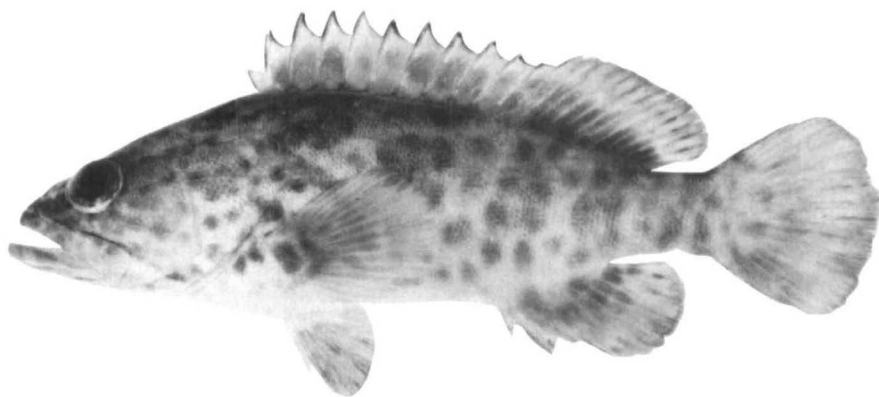


Figure 13. *Epinephelus malabaricus*, BPBM 21299, 91 mm SL, Bahrain.

orbit (generally about $\frac{1}{4}$ to $\frac{1}{2}$ orbit diameter posteriorly), the length of upper jaw 2.1–2.25 in head; interorbital space usually slightly convex; middle opercular spine about equidistant to upper and lower spines (more often closer to lower than upper spine); opercular membrane pointed, the upper margin slightly convex (especially proximally); posterior border of preopercle serrate, the convex corner with 3–5 enlarged serrae (though often largely covered by skin); margins of subopercle and interopercle smooth; third to sixth dorsal spines longest, subequal, 3.25–4.0 in head; longest dorsal soft rays (fifth to eighth) 2.25–2.9 in head; posterior dorsal and anal rays not reaching (or rarely, the dorsal rays barely reaching) a vertical at caudal fin base; caudal fin rounded; pectoral fins 1.75–2.15 in head; pelvic fins not reaching anus, 2.15–2.5 in head.

COLOR WHEN FRESH. Light grayish brown to greenish tan with five slightly diagonal broad dark bars (sometimes faint) on body which tend to bifurcate ventrally and to be broken or partially broken below their upper third; a short diagonal dark bar on nape; head and body with numerous small dark spots which

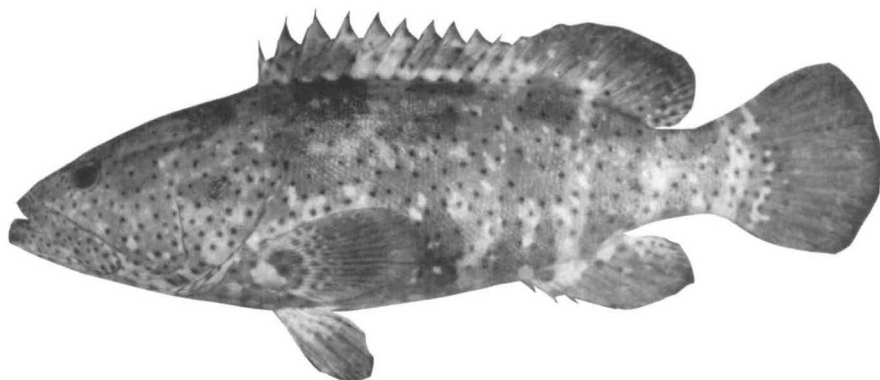


Figure 14. *Epinephelus malabaricus*, BPBM 21500, 451 mm SL, Saudi Arabia.

may vary in color from individual to individual from brownish orange to blackish (two of 312–321 mm SL caught in the same lift net at shore near Cochin, India, had spots of different color and size; those of one were brownish orange and relatively large compared to those of the other fish which were blackish); spots of smaller fish relatively larger (as large or larger than pupil on a 105-mm fish), less numerous, and many are found along edge of the dark bars; three dark spots on lower operculum particularly diagnostic (one at junction of subopercle and interopercle and two on interopercle); adults with small whitish spots on body and head which are less numerous, less distinct, not as round, and slightly larger than the dark spots; fins yellowish brown to gray (the triangular incised outer part of interspinous membranes yellowish), usually sparsely dark-spotted (and occasionally with whitish), the spots located mainly basally on most individuals; a dark streak at upper edge of maxillary groove.

Remarks.—The above diagnosis is based on 34 specimens in the Bishop Museum, Hebrew University, and Muséum National d'Histoire Naturelle, from the Red Sea, Mediterranean Sea, Djibouti, Persian Gulf, both coasts of India, Sri Lanka, northern Natal, and Indonesia. Measurements were taken from 18 specimens ranging from 172 to 880 mm SL. The weight of the largest specimen was 18.3 kg.

The holotype of *Epinephelus malabaricus* (ZMB 191, 158 mm SL) with the locality labelled Tranquebar was examined by the senior author at the Zoologisches Museum, East Berlin.

A number of authors such as Boulenger (1895) and Weber and de Beaufort (1931), have erroneously regarded *E. malabaricus* as a junior synonym of *E. tauvina*. Morgans (1965) has shown that there is a third species which has been confused with these two (see Discussion under *tauvina*). Because of this, it is difficult to conclusively place in synonymy the many names that have been given to the species of this complex without direct examination of types. It is also difficult to determine the distribution of these species from literature records.

E. malabaricus occurs from the northern end of the Red Sea and the Persian Gulf (where very important commercially) south to Natal and east to the western Pacific where it ranges from southern Japan to Queensland. Ben-Tuvia and Lourie (1969) reported it from the Mediterranean coast of Israel as *E. tauvina*. Its presence in the Mediterranean Sea is regarded as a result of passage through the Suez Canal (Ben-Tuvia, 1978).

This species does not extend its range to oceanic islands of the Pacific. It attains its greatest abundance along continental shores and large continental islands; it is unusual among the groupers in its penetration of turbid water and estuarine areas. That it can be found on isolated small islands, however, is indicated by a specimen from the Seychelles (MNHN 7304, 305 mm SL) and the type of *Epinephelus salmoides* (MNHN 5444, 212 mm SL) from Mauritius.

We include *Serranus semipunctatus* Valenciennes as a junior synonym of *E. malabaricus* as a result of the examination of the holotype in the Muséum National d'Histoire Naturelle by Phillip C. Heemstra.

Largest specimen examined, HUJ 8334, 880 mm SL, 1,050 mm TL, from Nuweiba, Sinai Peninsula. It weighed 18.3 kg. Morgans (1965) recorded the species from East Africa to 740 mm SL, 885 mm TL, and weights to 12.5 kg. He reported stomach contents of this species as fishes and shrimps. The senior author speared one of 600 mm SL in the Persian Gulf off Doha, which had eaten a large cuttlefish.

Dhawan and Gopinathan (1968) and Doiphode and Naik (1980) recorded *E. malabaricus* in excess of 2 m total length from India. Their specimens, however, appear to be *Promicrops lanceolatus* (Bloch).

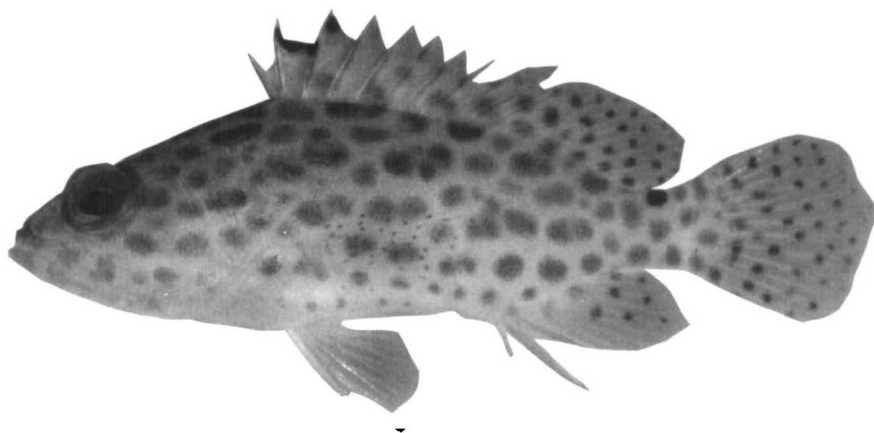


Figure 15. *Epinephelus microdon*, BPBM 19781, 39 mm SL, Sudan.

Epinephelus microdon (Bleeker)
Figures 15 and 16

Serranus microdon Bleeker, 1856a: 86 (type locality, Java); 1873–1876: 57, pl. 281, fig. 3.

Serranus dispar var. b. Playfair and Günther, 1867: 6, pl. 1, fig. 3 (type locality, Zanzibar).

Diagnosis.—Dorsal rays XI, 14 or 15; anal rays III, 8; pectoral rays 16 or 17 (usually 17); pored lateral-line scales 47–52; oblique scale rows from upper end of gill opening to caudal fin base 100–111; head scaled except for a zone from orbit to upper lip containing nostrils; scales ctenoid broadly on side of body and posteriorly, cycloid elsewhere; auxiliary scales present; gill rakers 9–10 + 16–18; teeth on side of dentary in two or three rows; depth of body 2.7–3.05 in SL; head length 2.4–2.5 in SL; snout 4.15–4.7 in head; maxilla extending posterior to eye by a horizontal distance equal to one-sixth to one-half orbit diameter, the upper jaw length 1.95–2.1 in head; interorbital space usually flat; middle opercular spine much closer to lower than upper spine; dorsal margin of opercular flap strongly convex except posterior end which is slightly produced; margin of preopercle rounded or with a slight prominence at angle, the posterior margin finely serrate dorsally, gradually becoming more coarsely serrate ventrally, the serrae at corner of moderate size; margins of subopercle and interopercle smooth; third or fourth dorsal spines longest, subequal, 2.8–3.3 in head; longest dorsal soft ray (fifth to seventh) 2.2–2.6 in head; posterior dorsal and anal rays not reaching (or dorsal rays just reaching) a vertical at caudal fin base; caudal fin rounded; pectoral fins 1.65–1.95 in head; pelvic fins not reaching anus, 1.95–2.35 in head.

COLOR WHEN FRESH. Light brown, paler ventrally, with large irregular brown blotches on head and body (those on body tending to be roundish); superimposed on this pattern numerous small, close-set, dark brown spots on head, body and fins (those on dorsal fin not as dense as elsewhere, the ones on spinous portion obliquely elongate; spots on anal and paired fins mostly on rays; spots relatively smaller and more numerous on larger individuals); a subquadrangular, saddle-like black spot dorsally on caudal peduncle.

Remarks.—The above diagnosis is based on 18 specimens in the Academy of Natural Sciences of Philadelphia, Bishop Museum, British Museum (Natural History), and U.S. National Museum of Natural History from the Red Sea, Zanzibar,

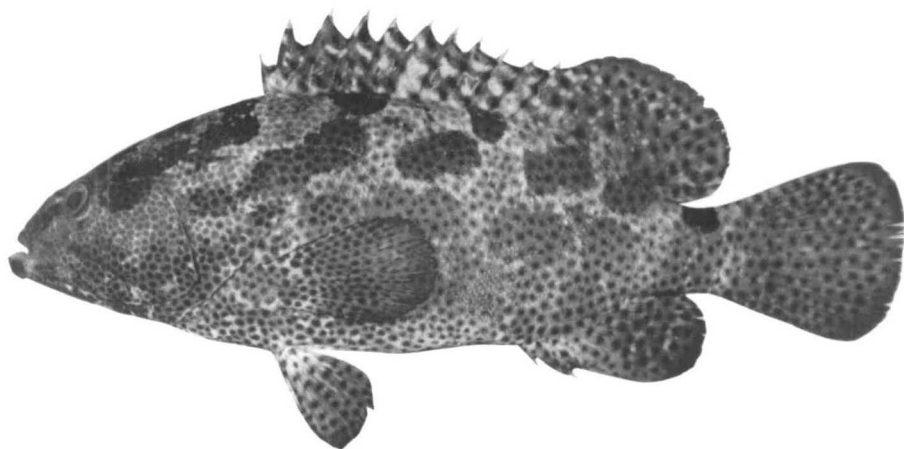


Figure 16. *Epinephelus microdon*, BPBM 18149, 312 mm SL, Sinai Peninsula.

Seychelles, and islands of Oceania. Measurements were taken from 12 specimens 129–408 mm SL.

This species has been confused by many authors with *E. fuscoguttatus* (see Remarks under the latter species).

Playfair and Günther (1867) described two “varieties” of grouper under the name *Serranus dispar*. Morgans (1959), in a paper on “three confusing species of serranid fish,” recognized *dispar* as a valid species of *Epinephelus*; he restricted this name to variety b. He placed variety a in the synonymy of *dispar* with a questionmark. A second member of the confusing triad treated by Morgans is *E. fuscoguttatus* which he correctly described in detail. He named the third a new species, *E. tukula*. As pointed out by Randall (1964), *Serranus dispar* var. a is *tukula*, but Morgans’ name remains valid because of his restriction of *dispar* to variety b. In the same paper Randall showed that *E. microdon* is an older name for *dispar*. He illustrated the holotype of *microdon* (RMNH 5510, 400 mm SL).

One of the three syntypes of *Serranus miliaris* Valenciennes in Cuvier and Valenciennes (1830) is a specimen of *E. microdon* (MNHN 7642, 100 mm SL, a dried half skin). Another syntype of *S. miliaris*, MNHN 7547, 149.5 mm SL, is here designated as the lectotype. This specimen is the same as the species described as *Serranus dictiophorus* (original spelling, *diktiophorus*) by Bleeker (1856b). Therefore, *Epinephelus miliaris* Valenciennes now becomes the senior synonym of *E. dictiophorus*.

Because many authors have not differentiated *E. microdon*, *fuscoguttatus* and *tukula*, it is difficult to ascertain the distributions of these three species from literature records without adequate descriptive information of the fishes. However, *E. microdon* definitely occurs in the Red Sea (Rüppell, 1830, as *Serranus fuscoguttatus*), East Africa from Pemba Island to Mafia Island (Morgans, 1959), Seychelles (Smith and Smith, 1963, as *E. dispar*), Chagos Archipelago (Kyushin et al., 1977, as *E. fuscoguttatus*), Maldiv Islands (underwater photos by the senior author), Indonesia (type locality), Philippines (Fowler and Bean, 1930, in part—combined with *E. fuscoguttatus*), southern Japan (Masuda et al., 1975), New Caledonia (Fourmanoir and Laboute, 1976: right-hand figure), Queensland (Grant, 1978, also combined with *E. fuscoguttatus*), Lord Howe Island (Allen et al., 1976),

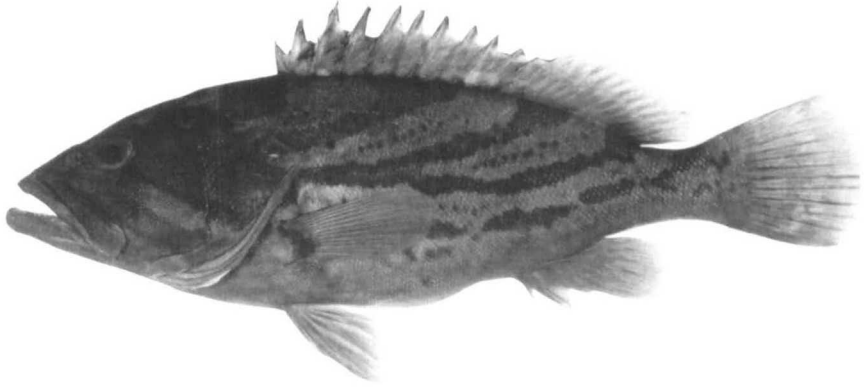


Figure 17. *Epinephelus morrhua*, BPBM 21504, 345 mm SL, Saudi Arabia.

and throughout most of Oceania (Fowler, 1928, in part; Schultz in Schultz and collaborators, 1953, in part; and Randall, 1955, as *E. fuscoguttatus*; Schultz in Schultz and collaborators, 1966: addenda, as *E. horridus*; Bagnis et al., 1972; Plessis and Maugé, 1978; Shepard and Myers, 1981).

E. fuscoguttatus is found primarily on well-developed coral reefs; it attains its greatest abundance at islands, particularly atolls. Randall and Brock (1960), Hiatt and Strasburg (1960), Helfrich et al. (1968), and Randall (1980b) reported on the food habits. It feeds mainly on benthic crustaceans (especially crabs), with fishes a close second.

The largest specimen examined by us, 610 mm SL, was collected at Rapa.

Epinephelus morrhua (Valenciennes)

Figure 17

Serranus morrhua Valenciennes in Cuvier and Valenciennes, 1833: 434 (type locality, Mauritius).
Epinephelus cometae Tanaka, 1927: 704, pl. 159, fig. 445, pl. 160, fig. 447 (type locality, Tanabe, Wakayama Prefecture, Japan).

Diagnosis.—Dorsal rays XI, 14 or 15; anal rays III, 7 or 8 (two of six with 7); pectoral rays 17 or 18; pored lateral-line scales 58–64; oblique scale rows from upper end of gill opening to caudal fin base 108–120; head scaled except zone from orbit to upper lip containing nostrils; scales ctenoid except head, nape, thorax and anterior abdomen where cycloid; auxiliary scales not present on body (except on lateral-line scales); gill rakers 8–10 + 15–17; teeth on side of dentary in two rows, those of the medial rows slightly longer and depressible inward; depth of body 2.85–3.1 in SL; head length 2.25–2.45 in SL; snout 3.5–4.1 in head; maxilla reaching a vertical at hind margin of orbit, the upper jaw length 2.05–2.2 in head; interorbital space slightly convex; middle opercular spine closer to lower than upper spine; opercular membrane pointed, the dorsal edge nearly straight (slightly convex on proximal half and very slightly concave or straight on distal half); posterior margin of preopercle serrate, the corner produced and armed with four or five enlarged serrae; margins of subopercle and interopercle partially serrate; third dorsal spine longest, 2.65–3.2 in head; longest dorsal soft ray (sixth) 2.55–2.8 in head; posterior dorsal and anal rays not reaching a vertical at caudal fin base; caudal fin slightly to moderately rounded; pectoral fins 1.9–2.3 in head; pelvic fins not reaching anus, 2.1–2.5 in head.

COLOR WHEN FRESH. Light brown, with dark brown bands as follows: one from upper posterior part of eye passing above upper ends of preopercular margin and gill opening and ending broadly on nape at origin of dorsal fin; one from upper edge of opercular flap, broadening above lateral line, and ending at base of fifth to ninth dorsal spines; one from behind middle of eye across operculum (faint on postorbital head) onto midside of body, bifurcating above distal end of pectoral fin, the upper segment extending to base of anterior soft portion of dorsal fin and the lower part to rear base of fin (both segments broadening as they approach base of fin); a broken one from beneath pectoral fin along lower side, curving upward to end dorsally on caudal peduncle; two diagonal bands on cheek, one from lower edge of orbit to lower part of opercle, and a broader one from above maxilla to anterior preopercular margin; a row of brown spots on body between adjacent dark brown bands and one extending posteriorly from lower edge of pectoral fin base; median and pelvic fins light brown; pectoral fins with hyaline membranes and light brown rays.

Remarks.—The above diagnosis is based on four Bishop Museum specimens, 345 to 442 mm SL, from the Red Sea, Mauritius, Okinawa and Belau; one in the U.S. National Museum of Natural History from the Philippines (282 mm SL); one in the British Museum (Natural History) from Japan; and a seventh (374 mm SL) from the fish market in Jeddah which was not retained.

Epinephelus morrhua is one of a complex of four deep-dwelling groupers with curved dark bands on the head and body. It is sympatric with two of these. There has been confusion as to which of the three should bear the name *morrhua*, largely because Valenciennes' description of *morrhua* is not sufficiently detailed. The second species of the complex to be described was *E. poecilonotus* (Temminck and Schlegel, 1842) from Japan, and the third *E. radiatus* (Day, 1867) based on a 4-inch fish from the vicinity of Madras, India (*E. döderleinii* Franz, 1910, is a junior synonym). Some authors, such as Boulenger (1895), Weber and de Beaufort (1931), and Herre (1953), have regarded *poecilonotus* and *radiatus* as synonyms of *morrhua*. Tanaka (1927) created a synonym of *morrhua* when he described *E. cometae* from Japan in the belief that *E. poecilonotus* was the same as *morrhua*. Others, such as Masuda et al. (1975) and Kyushin et al. (1977), have followed Tanaka. Katayama (1960) regarded the three species as subspecies of *morrhua* and recorded all three from Japan. The fourth member of the complex, *E. tuamotuensis* Fourmanoir, is known only from a few islands in Polynesia.

Marie-Louise Bauchot of the Muséum National d'Histoire Naturelle was asked to check the color pattern of the holotype of *E. morrhua* (MNHN 7431, 296 mm SL). Although the bands have largely faded, she was able to see enough of the pattern on one side to ascertain that it is the same as the fish illustrated herein as Figure 17.

E. morrhua is not well represented in fish collections, probably because of its predilection for deep water. It is known from Mauritius (type locality), Red Sea (Klunzinger, 1870; 1884), Réunion (Bleeker and Pollen, 1874), Japan [Steindachner and Döderlein, 1883: pl. 5, fig. 2, as *Serranus (Epinephelus) brunneus* Bloch], Madagascar (Sauvage, 1891), Gulf of Oman (Boulenger, 1889), Indonesia (Weber and de Beaufort, 1931), Comoro Islands (Fourmanoir, 1957, as *Epinephelus latifasciatus*), New Caledonia (Fourmanoir and Laboute, 1976), Zanzibar (Morgans, MS), Chagos Archipelago and Bay of Bengal (Kyushin et al., 1977).

The following depth records have been given for the species: 150–200 fathoms (=275–366 m) (Klunzinger, 1884); 150–250 m (Fourmanoir, 1957); the young at 140 m, adults up to 260 m (Fourmanoir and Laboute, 1976); 117–125 m (Morgans, MS).

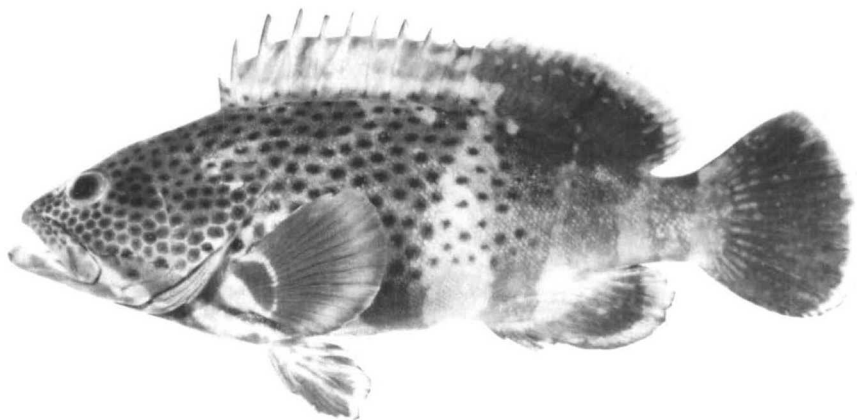


Figure 18. *Epinephelus stoliczkae*, BPBM 21448, 198 mm SL, Oman.

Fourmanoir and Laboute (1976) gave the maximum length of this grouper as 900 mm. The largest recorded by other authors is 560 mm TL.

Epinephelus stoliczkae (Day)

Figure 18

Serranus Stoliczkae Day, 1875: 10, 11, pl. 1, fig. 3 (type locality, coast of Sind).

Diagnosis.—Dorsal rays XI, 16–18; anal rays III, 8; pectoral rays 17 or 18; pored lateral-line scales 48–51; oblique rows of scales between upper end of gill opening and caudal fin base 97–106; head scaled except for a zone from orbit to upper lip containing nostrils; scales cycloid except a few weakly ctenoid ones on body in region of distal part of pectoral fin; auxiliary scales present; gill rakers 6–7 + 13–15; teeth on side of lower jaw in two rows; depth of body 2.9–3.15 in SL; head length 2.3–2.65 in SL; snout relatively short, 4.8–5.0 in head; maxilla extending posterior to hind edge of orbit, the upper jaw length 2.25–2.35 in head; interorbital space moderately convex; middle opercular spine usually equidistant to upper and lower spines; opercular flap moderately pointed; dorsal edge of opercular membrane nearly straight; posterior border of preopercle serrate, the serrae at corner somewhat enlarged; ventral border of preopercle smooth and membranous; margin of subopercle and interopercle smooth except for two small serrae on subopercle of one specimen; longest dorsal spine (fourth to sixth) 2.4–3.1 in head; longest dorsal soft ray (sixth to ninth) 2.25–2.8 in head; posterior dorsal rays just reaching a vertical at caudal fin base; caudal fin rounded; pectoral fins 1.7–1.95 in head; pelvic fins short, not approaching anus, 2.1–2.45 in head.

COLOR WHEN FRESH. Yellowish gray with a dark gray-brown bar below rear of spinous portion of dorsal fin, two more bars close together beneath soft portion, and one on caudal peduncle (dorsal part of the peduncular bar nearly black); head and body with numerous dark orange-red spots except ventrally and posteriorly, those on head denser; thorax pale with a narrow dark diagonal band and a broad dark blotch nearly crossing pectoral base; spinous portion of dorsal fin yellowish with a row of dark reddish spots along the base and two faint dark longitudinal bands, the membrane tips yellowish white; remaining fins mainly dark yellowish gray-brown, the posterior margins of the median fins with a very narrow dark edge and a broad yellowish submarginal band.



Figure 19. *Epinephelus summana*, BPBM 20706, 39 mm SL, Sudan.

Remarks.—The diagnosis above is based on 13 specimens from the Bishop Museum and British Museum (Natural History) from the Gulf of Oman, Djibouti and the Red Sea. Measurements were made of nine of these specimens, 153–246 mm SL. Boulenger (1895) who examined specimens of *E. stoliczkae* from Massaua, Aden, and Muscat, listed the largest as having a total length of 380 mm.

This species ranges from the Red Sea through the Gulfs of Aden and Oman to the coast of Pakistan. Day gave the locality for his material as the coast of Sind, adding that the species is very common at Aden.

Whitehead and Talwar (1976) stated that Day's specimens of *E. stoliczkae* were deposited in the museums at Calcutta, Sydney, Berlin, Leiden, and Paris. Day's illustrated specimen (ZSI 1679, 122 mm SL) is in the Indian Museum in Calcutta; it is here selected as the lectotype, thus restricting the type locality to Sind (=Pakistan).

The senior author observed this grouper in the Gulf of Tadjoura and in the Gulf of Oman around small coral heads on shallow bottoms dominated by sand. We have only one Red Sea specimen (HUJ 9150, 280 mm SL) collected by the junior author in the southern Red Sea (Dahlak Archipelago, Coast of Ethiopia). The other Red Sea records are from Massaua and the Gulf of Suez (the latter reported by Gruvel, 1936).

Epinephelus summana (Forsskal)

Figures 19 and 20

Perca summana Forsskal, 1775: xi, 42 (type locality, Arabia).

Serranus leucostigma [Ehrenberg, MS] Valenciennes in Cuvier and Valenciennes, 1828: 346 (type locality, Massaua, Red Sea).

Sebastes meleagris Peters, 1865: 392 (type locality, Massaua, Red Sea).

Diagnosis.—Dorsal rays XI, 14 to 16 (usually 15); anal rays III, 8 or 9 (rarely 9); pectoral rays 16 to 18 (7 of 19 specimens with 16, one with 18); lateral-line scales 49–54; oblique scale rows from upper end of gill opening to caudal fin base 95–109; head scaled except for a small area from orbit to nostrils; auxiliary scales present on body; gill rakers 8–10 + 16–17; more than two rows of teeth on side of lower jaw; depth of body 2.75–3.1 in SL; head length 2.25–2.4 in SL; snout length 4.25–4.7 in head; maxilla reaching to or slightly posterior to rear edge of orbit, the upper jaw length 2.2–2.4 in head; interorbital space usually flat; middle

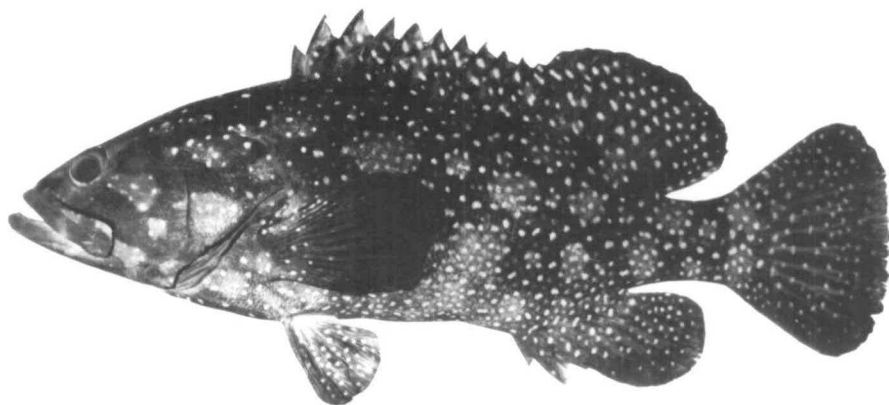


Figure 20. *Epinephelus summana*, BPBM 20763, 334 mm SL, Sudan.

opercular spine distinctly nearer lower than upper spine; dorsal margin of opercular flap strongly convex; posterior margin of preopercle finely serrate, a few serrae at upper edge of corner slightly enlarged; margins of subopercle and interopercle smooth or with only a few small serrae; longest dorsal spine (third or fourth) 2.75–3.15 in head; longest dorsal soft ray (sixth to ninth) 2.25–2.75 in head; posterior dorsal rays not reaching to or posterior to base of caudal fin; caudal fin rounded; pectoral fins 1.7–2.1 in head; pelvic fins not reaching anus, 2.3–2.7 in head.

COLOR WHEN FRESH. Dark brown to dark brownish gray with roundish paler brown blotches (mostly as large or larger than eye) and numerous small whitish spots overlying this entire pattern (fewer whitish spots on head); a prominent black streak along upper edge of maxillary groove; fins dark brown with small white spots (may only be basally on pectoral fins). Juveniles brownish gray with large dark-edged white spots on head, body, and median fins; pectoral fins blackish with white spots which coalesce into irregular transverse bands on all but basal part of these fins.

Remarks.—The above diagnosis is based on 19 specimens from the Bishop Museum, British Museum (Natural History), Muséum National d'Histoire Naturelle, and the U.S. National Museum of Natural History. Measurement data were taken from 13 specimens 150–428 mm SL.

This species appears to be confined to the Red Sea. It is generally found on reefs in lagoons or other protected waters, sometimes as shallow as 1 m or less. It will enter brackish water environments. Largest specimen examined [BM(NH) 1951.1.16.111], 428 mm SL and 520 mm total length.

E. summana is closely related to the allopatric *E. ongus* (Bloch) which ranges from East Africa to Micronesia. It differs from *ongus* in having shorter pectoral fins (1.7–2.1 in head, compared to 1.5–1.7 for *ongus*), shorter pelvic fins (2.3–2.7 in head, compared to 2.05–2.35), a larger posterior nostril which becomes vertically oval on adults (smaller and rounder in *ongus*), and in color. The whitish spots on the body of *ongus* are smaller; on adults they tend to join to form irregular narrow longitudinal bands, especially posteriorly on the body. In addition, *ongus* has a narrow white margin and broad blackish submarginal band posteriorly on the median fins; these markings are absent or poorly developed on *summana*.

For an illustration of *E. ongus* see Randall (1980b: fig. 19), a specimen from Ponape misidentified as *E. socialis*.

Epinephelus caeruleopunctatus (Bloch) has often been confused with *E. summana* and *E. ongus*. It is brown with whitish to yellowish spots of unequal size but without the overlying pattern of numerous small whitish spots; generally there are only a few to no whitish spots on the caudal, anal, and paired fins. Some meristic differences, though overlapping, are often useful in providing separation from *summana* and *ongus*. *E. caeruleopunctatus* has 16 or 17 dorsal soft rays, 17 to 19 pectoral rays, and 15 or 16 lower-limb gill rakers.

We have not observed *E. caeruleopunctatus* in the Red Sea. The Red Sea record appears to be the listing by some authors of *Serranus leucostigma* Valenciennes (type locality, Red Sea) as a junior synonym of *E. caeruleopunctatus*. The description of this species, attributed to Ehrenberg by Valenciennes, was based on a drawing of a "small near-cousin of *summana*." A copy of what is believed to have been the drawing from Ehrenberg was sent by Martine Desoutter of the Muséum National d'Histoire Naturelle. Though the drawing is only a simple sketch and the description of only four lines, we believe this fish was a juvenile of *E. summana*, not *caeruleopunctatus*.

The holotype of *Perca summana*, ZMC P-43569, 170 mm SL, is in the Zoological Museum of Copenhagen (Klausewitz and Nielsen, 1965: 18, pl. 10, fig. 22).

Epinephelus tauvina (Forsskål)

Figures 21 and 22

Perca tauvina Forsskål, 1775: 39 (type locality, Jeddah).

Holocentrus pantherinus Lacepède, 1801: pl. 27, fig. 3; 1802: 345, 389 (type locality, Madagascar).

Serranus Janseni Bleeker, 1857b: 376 (type locality, Sangi Island); 1873-76: 51, pl. 289, fig. 5.

Epinephelus elongatus Schultz in Schultz and collaborators, 1953: 345, fig. 53, pl. 25C (type locality, Enewetak Atoll, Marshall Islands).

Epinephelus salonotus Smith and Smith, 1963: 15, pl. 14I (type locality, Delgado, Mozambique).

Epinephelus chewa Morgans, 1965: 258, 267, pl. IXD (type locality, Mafia Island, Tanzania).

Diagnosis.—Dorsal rays XI, 14–16; anal rays III, 8; pectoral rays 18 or 19 (11 of 21 specimens with 18); pored lateral-line scales 67–74; oblique rows of scales between upper end of gill opening and caudal fin base 98–110; head scaled except for a zone from orbit to upper lip containing nostrils; scales cycloid except side of body where ctenoid (region of ctenoid scales variable in extent from individual to individual); auxiliary scales present; gill rakers 8–10 + 18–20 (modally 19); teeth on side of dentary in three or four rows; depth of body 3.15–3.5 in SL; width of body 1.7–2.2 in depth; head large, the length 2.15–2.4 in SL; snout 4.5–5.0 in head; maxilla extending well posterior to hind border of orbit (generally $\frac{1}{2}$ to a full orbit diameter in horizontal distance posterior to orbit—relatively more posterior on larger individuals); length of upper jaw 1.95–2.05 in head; interorbital space usually flat; middle opercular spine usually slightly closer to lower than upper spine; opercular membrane pointed, the upper margin moderately convex on about proximal half and straight to slightly concave on distal half; preopercular margin broadly rounded (only slightly angular at corner), the posterior edge serrate, the corner without greatly enlarged serrae; margins of subopercle and interopercle smooth; third to fifth dorsal spines longest, subequal, 3.15–4.6 in head (relatively shorter on larger individuals, in general); longest dorsal soft ray (sixth or seventh) 2.5–3.2 in head; posterior dorsal and anal rays not reaching (or the dorsal rays barely reaching) a vertical at caudal fin base; caudal fin rounded; pectoral fins 1.85–2.3 in head; pelvic fins not reaching anus, 2.3–2.7 in head.

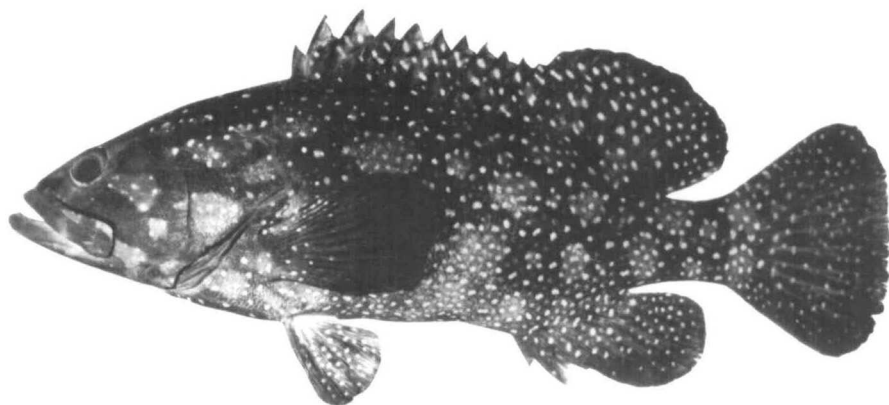


Figure 21. *Epinephelus tauvina*, BPBM 20086, 145 mm SL, Mauritius.

COLOR WHEN FRESH. Greenish gray to pale brown dorsally, shading to whitish ventrally, with numerous (but well-spaced) round dark spots which may vary in color from dull orange-red to dark brown, the centers darker than edges (spots relatively smaller and more numerous on larger individuals); spots anteriorly on head smaller and closer together than posteriorly; five faint slightly diagonal dusky bars or rows of blotches may be visible on body; a large blackish spot often present on back at base of last four dorsal spines and extending into lower part of fin (or dark spots in this area darker than surrounding spots), this spot more evident in small individuals; one group of spots at base of fourth and fifth dorsal spines, two along base of soft portion of dorsal fin, and one dorsally on caudal peduncle often darker than other spots; fins with dark spots as on body except on pectorals where they become progressively smaller distally (sometimes faint or absent on about outer fourth of fin); posterior edge of caudal fin, pectoral fin, and soft portion of anal fin narrowly whitish.

Remarks.—The above diagnosis is based on nine Bishop Museum specimens (three from the Red Sea, three from Mauritius, two from Réunion, and one from Belau), three Zanzibar specimens from the Academy of Natural Sciences of Philadelphia, and nine Red Sea specimens from the collection of the Hebrew University. Measurements were made on 11 specimens ranging from 145–407 mm SL.

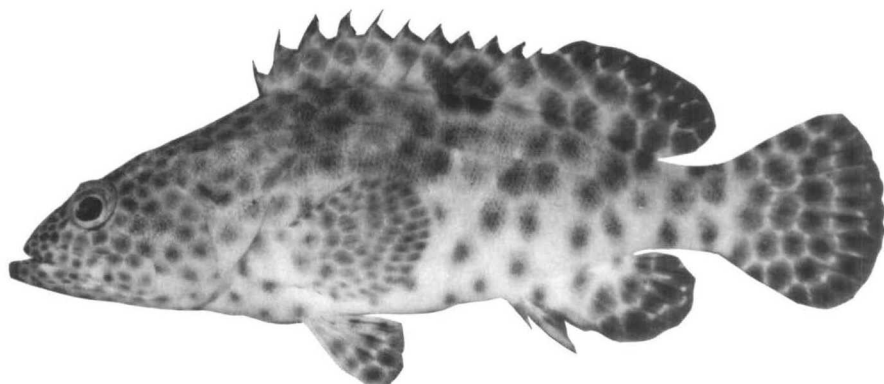


Figure 22. *Epinephelus tauvina*, BPBM 20768, 407 mm SL, Sudan.

The holotype of *Perca tauvina* Forsskål (ZMC P.43565 = ZM, cph-18 the number of the species in Forsskål's collection within the Zoological Museum, Copenhagen, a dried skin of the left side, 171 mm SL) was examined by the senior author. It has been illustrated by Randall (1964: fig. 12) and Klauswitz and Nielsen (1965: pl. 8).

Much confusion has centered on the use of the name *Epinephelus tauvina*. Boulenger (1895) listed 19 synonyms under this name, including *E. malabaricus*. He was largely followed by Weber and de Beaufort (1931) and others. A very large size, to 2 m, has been erroneously attributed to this species.

Katayama (1960) correctly distinguished *E. tauvina* from *E. malabaricus*; he placed *E. elongatus* Schultz from the Marshall Islands in the synonymy of *tauvina*. Randall (1964) illustrated the holotype of *E. tauvina* (ZMC 18, 171 mm SL), added *E. salonotus* Smith and Smith to the synonymy, and extended the range to the Society Islands where he noted that it was observed in the depth range of 10–150 feet. The largest specimen examined by him measured 498 mm SL.

Morgans (1965) contended that three species have been confused under the name *tauvina*; he measured specimens of the species he regarded as the true *tauvina* to 2,000 mm SL, 2,340 mm TL, which weighed about 300 pounds. He added that he estimated other individuals of this species seen underwater to grow to at least twice that weight. According to Morgans, the second species of the complex is *malabaricus*, and the third he described as new, *E. chewa*, from four specimens ranging from 283 to 488 mm SL taken at Mafia Island and Latham Island, East Africa. Morgans' identification of *E. malabaricus* is correct, but his *E. chewa* appears to be the true *tauvina*. We are uncertain of the identity of the giant species he thought was *tauvina*. The larger individuals he saw may have been *E. lanceolatus* (Bloch). No one has demonstrated that there are two immense species of groupers off East Africa. If there is a second one, it may be *Epinephelus abdominalis* (Peters) 1855. This fish was taken off Mozambique; it measured 1,700 mm. We have seen no specimens of *E. tauvina* larger than 500 mm SL. Fourmanoir and Laboute (1976), however, have recorded it to 700 mm TL.

E. tauvina may be distinguished from *E. malabaricus* by having more pored lateral-line scales (67–74, compared to 58–64), more lower-limb gill rakers (18–20, compared to 15–18), two instead of three or four rows of teeth on side of dentary, a longer head (but shorter snout relative to head length), longer upper jaw, narrower body, and in some details in color. *E. malabaricus* lacks the large blackish spot at the rear base of the spinous portion of the dorsal fin, and its slightly diagonal dark bars are much more evident. In addition, Katayama (1960: 85) has separated these two species (he used the name *salmonoides* on this page but *malabaricus* was intended) by *tauvina* having 16 to 18 pyloric caeca (instead of 45), a more slender body (true on the average but there is overlap), and a more slender caudal peduncle.

E. tauvina is primarily a clear-water, coral-reef species which may be encountered in as little as 1 m of water. It is more abundant in insular areas than along continental shores. The Red Sea is an exception in this case, due no doubt to the well-developed fringing reefs and limited areas affected by freshwater drainage. The illustrated specimen from the Persian Gulf identified by Randall et al. (1978) as *E. tauvina* is *E. malabaricus*; *E. tauvina* is not known from the Gulf.

This grouper occurs throughout most of the Indo-Pacific; it ranges from the northern end of the Gulf of Aqaba south to Mozambique and east to Ducie Atoll in the Pitcairn Group (Rehder and Randall, 1975). The species has been recorded once from the Hawaiian Islands (as *Serranus phaeostigmaeus* Fowler, 1907, which was considered later by Fowler and others as a junior synonym of *E. tauvina*).

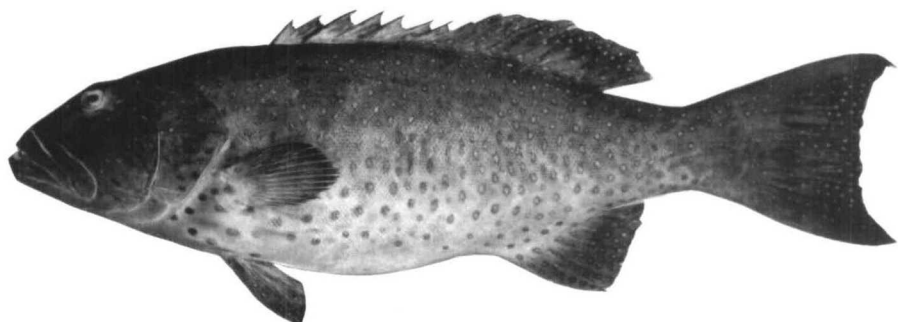


Figure 23. *Plectropomus maculatus*, BPBM 18146, 480 mm SL, Sinai Peninsula.

The holotype of *S. phaeostigmaeus* (ANSP 13463, 170 mm SL) was examined by the senior author at the Academy of Natural Sciences of Philadelphia. It proved to be a juvenile of the giant species *Promicrops lanceolatus* (Bloch).

Randall (1980b) opened the stomachs of 34 specimens of *E. tauvina* 204–500 mm SL; of the 19 which contained food, one had eaten a crab and the rest fishes (including members of the Holocentridae, Mullidae, and Pomacentridae). In an earlier food-habit study (Randall and Brock, 1960), three of 12 fish with food in the stomachs had also eaten fishes (one with a crab chela as well). Morgans (1965) found food in two stomachs of his *E. chewa*; this consisted of fish remains and pieces of squid.

Plectropomus maculatus (Bloch)

Figure 23

Bodianus maculatus Bloch, 1790: 48, pl. 228 (type locality said to be Japan, but more likely East Indies).

Plectropoma punctatum Quoy and Gaimard, 1824: 318, pl. 45, fig. 1 (type locality, Mauritius).

Plectropoma areolatum Rüppell, 1828: footnote on second page of index (type locality, Red Sea).

Plectropoma pessuliferum Fowler, 1904: 520, pl. 17, upper figure (type locality, Padang, Sumatra).

Diagnosis.—Dorsal rays VIII,11; anal rays III,8; pectoral rays 15–17 (one of 20 specimens with 15 and one with 17); pored lateral-line scales 88–104; oblique rows of scales from upper end of gill opening to caudal-fin base 123–132; auxiliary scales present; scales on body of small specimens ctenoid, on large ones cycloid; interorbital space naked; developed gill rakers (distinctly higher than broad) on first gill arch 2–4 + 7–10; raker at angle longer than gill filaments; one to three large fixed canine teeth on side of lower jaw in addition to two rows of small teeth and a pair of large canines anteriorly in jaw; depth of body 3.25–3.65 in SL; head length 2.9–3.1 in SL; interorbital space flat; suborbital depth 5.8–7.8 in head; snout length 2.75–3.4 in head; maxilla extending from slightly anterior to slightly posterior to a vertical at rear edge of orbit, the upper jaw length 2.0–2.2 in head; anterior and posterior nostrils subequal; middle opercular spine nearer lower than upper spine; posterior margin of preopercle finely serrate, the ventral margin with three antrorse spines; dorsal spines slender and short, the third or fourth longest, 3.25–4.1 in head; third to fifth dorsal soft rays longest, 2.2–3.0 in head; posterior ends of dorsal and anal rays not approaching caudal fin base; caudal fin emarginate, the caudal concavity 4.7–7.6 in head; pectoral fins short, 1.95–2.45 in head; pelvic fins short, 1.7–2.35 in head, their length contained about 1.4 times in distance from pelvic fin base to anus.

COLOR WHEN FRESH. Brownish orange-red (more brown dorsally, light red ventrally) with dark-edged blue spots which vary from round to elongate (those on head and anterior half of body more apt to be elongate and some often enlarged); blue spots generally separated by spaces two or more times the spot diameters; blue spots not present ventrally on abdomen; a narrow blue margin partially surrounding eye; median fins darker orangish brown, especially distally, with smaller blue spots; pectoral fins with dark brown rays, pale membranes, a few blue spots (mainly basally), and a pale posterior edge; pelvic fins orangish brown with blue spots.

Remarks.—The above diagnosis is based on 21 specimens from the Red Sea (eight specimens, of which three not saved), Comoro Islands, Mauritius, St. Brandon's Shoals, Thailand, Java, Ambon, Singapore, Queensland, and Philippines in the collections of the Academy of Natural Sciences of Philadelphia, Bishop Museum, British Museum (Natural History), California Academy of Sciences, Muséum National d'Histoire Naturelle, U.S. National Museum of Natural History, and Zoological Museum of the University of Copenhagen. Measurements were taken on 13 specimens, 169–489 mm SL.

The holotype of *Bodianus maculatus* Bloch (ZMB 8599, a dried half skin 219 mm SL) was examined by the senior author in the Zoologisches Museum, East Berlin. The locality given on the label of the specimen is Japan; however, this is probably in error; an East Indian type locality is more likely.

The holotype of *Plectropoma punctatum* Quoy and Gaimard (MNHN 7676, 143 mm SL) from Mauritius was examined by the senior author at the Muséum National d'Histoire Naturelle. It appears to be a small example of *P. maculatus*. Curiously, four separate field trips by the senior author to Mauritius totaling nearly three months of diving, with frequent checks at the Port Louis fish market, failed to reveal any specimens of the genus *Plectropomus*. Possibly the extensive fishing from this heavily populated island has greatly reduced the populations of species of this genus.

P. maculatus occurs from the Red Sea and east coast of Africa to the western Pacific where it ranges from the Ryukyu Islands (Masuda et al., 1975—as a color variant of *P. leopardus*) to the Great Barrier Reef (Marshall, 1964). It is unknown from islands of Oceania. Bleeker (1876) listed the species (as *Paracanthistius maculatus*) from Singapore, Java, Celebes (now Sulawesi), Halmahera, and Ternate and illustrated it in color (pl. 291, fig. 3), labelled *Acanthistius maculatus*. Kyushin et al. (1977) recorded it from the Andaman Islands, Chagos Archipelago and Nazareth Bank in the Indian Ocean from depths of 13–160 m.

Largest specimen examined by us, 712 mm SL, from the Gulf of Aqaba, Red Sea.

A number of authors, such as Boulenger (1895) and Weber and de Beaufort (1931), have regarded *Plectropomus leopardus* (Lacepède) and *P. melanoleucus* (Lacepède) [= *P. laevis* (Lacepède)] as color forms of *P. maculatus*. These two species, however, are valid. In their *The Fishes of Seychelles*, Smith and Smith (1963) illustrated *P. laevis*, *P. leopardus*, and *P. marmoratus* Talbot in color on Plate 96, A, B, and C, respectively, all as *P. maculatus*.

Plectropoma pessuliferum Fowler (1904) from Padang, Sumatra has been regarded by Fowler and Bean (1930) and others as a junior synonym of *P. maculatus*. Although in most respects the description and figure suggest *maculatus*, the large posterior nostril does not. In *P. maculatus* the posterior nostril is normally about the same size as the anterior. At our request Eugenia B. Böhlke of the Academy of Natural Sciences of Philadelphia examined the nostrils of the holotype of

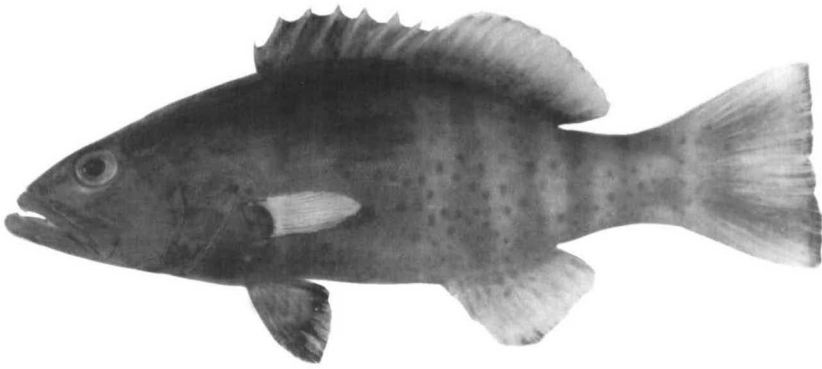


Figure 24. *Plectropomus truncatus*, BPBM 20817, 117 mm SL, Gulf of Aqaba.

Plectropoma pessuliferum (ANSP 27546, 329 mm SL). On the left side, as illustrated, the anterior nostril is distinctly smaller (2.5 mm in greatest diameter) than the posterior nostril (5 mm); on the right side the anterior measures 3 mm and the posterior 3.8 mm. Both nasal openings are abnormally large for a *Plectropomus* of this size. This may be an artifact of preservation. We provisionally place *pessuliferum* in the synonymy of *maculatus*.

Plectropomus truncatus Fowler and Bean
Figures 24 and 25

Plectropomus truncatus Fowler and Bean, 1930: 196, fig. 5 (type locality, Atulayan Island, Lagonoy Gulf, east coast of Luzon).

Diagnosis.—Dorsal rays VIII,11; anal rays III,8; pectoral rays 15 or 16 (usually 16); pored lateral-line scales 88–105; oblique rows of scales from upper end of gill opening to caudal fin base 110–138; auxiliary scales present; scales of adults cycloid, ctenoid in juveniles; interorbital space scaled (scales embedded in adults); developed gill rakers (distinctly higher than broad) on first gill arch 0–2 + 2–9; raker at angle shorter than gill filaments; one to three large canine teeth on side of lower jaw in addition to two rows of small teeth and one or two pairs of large canines anteriorly in jaw; depth of body 3.1–3.75 in SL; head length 2.8–3.0 in SL; interorbital space slightly concave to flat; suborbital depth 8.0–9.9 in head; maxilla reaching to or slightly beyond a vertical at rear edge of orbit, the upper jaw length 2.05–2.1 in head; anterior and posterior nostrils subequal; middle opercular spine nearer lower than upper spine; posterior margin of preopercle finely and irregularly serrate (serrae may be obsolete on adults), the ventral margin with three antrorse spines; dorsal spines slender and short, the third or fourth longest, 3.25–3.8 in head; third to fifth dorsal soft rays longest, 2.4–2.65 in head; posterior ends of dorsal and anal rays not approaching caudal fin base; caudal fin truncate to slightly emarginate (the caudal concavity at most 13 in head); pectoral fins short, 2.0–2.3 in head; pelvic fins very short, the tips reaching about half distance from their base to anus, their length 2.05–2.45 in head.

COLOR WHEN FRESH. Orangish brown with numerous small round black-edged blue spots, these spots close-set (often within a spot diameter of adjacent spots) and extend onto ventral part of abdomen; a narrow ring of blue nearly encircling eye; median fins with black-edged blue spots of smaller size; caudal fin with a

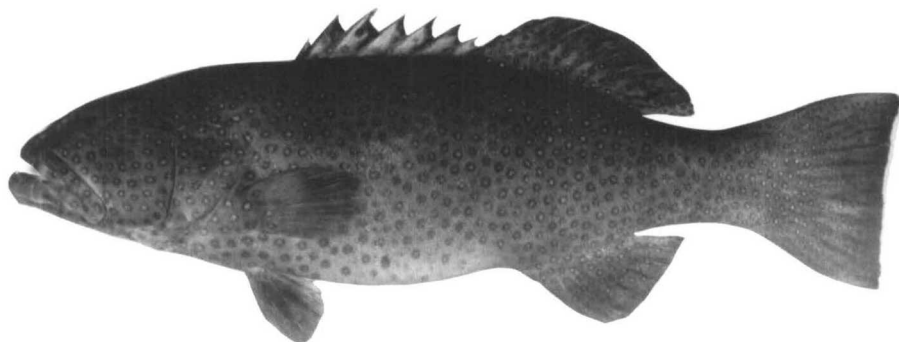


Figure 25. *Plectropomus truncatus*, BPBM 21503, 368 mm SL, Saudi Arabia.

distinct white posterior margin and blackish submarginal zone; soft portion of dorsal fin sometimes with a narrow whitish margin; pectoral fins with dusky rays (becoming pale distally), pale membranes, and small blue spots basally; pelvic fins dark orangish brown, usually without spots, becoming orange at base.

Remarks.—The above diagnosis is based on 20 specimens from the Red Sea, Cocos-Keeling Islands, and Kapingamarangi in the Caroline Islands from the Academy of Natural Sciences of Philadelphia, Bishop Museum, British Museum (Natural History), California Academy of Sciences, Senckenberg Museum, and U.S. National Museum of Natural History. Measurements were made of 15 of these fish, 151–388 mm SL. In addition, other specimens were examined from the Marshall Islands, Gilbert Islands (Kiribati), Samoa Islands, Solomon Islands, and Philippines. In the western Pacific this species is known from the Ryukyu Islands (Masuda et al., 1975) to the northern Great Barrier Reef (Hoese et al., 1981).

The holotype of *Plectropomus truncatus* (USNM 89984, 350 mm total length) is in the U.S. National Museum of Natural History. The largest specimen reported is 520 mm total length, from Borneo (Fowler and Bean, 1930).

Although common in the Red Sea and well known in the Pacific east to Samoa and the Marshalls, there seem to be available specimens of *P. truncatus* from the Indian Ocean only from the Cocos-Keeling Islands. The report of *P. truncatus* from the Chagos Archipelago by Kyushin et al. (1977) is a misidentification of species of *Plectropomus* which may be undescribed (D. Hoese, personal communication). However, we can confirm the presence of *truncatus* at the Maldive Islands from underwater photos taken in the lagoon of North Male Atoll by the senior author.

Variola louti (Forsskål) Figures 26 and 27

Perca louti Forsskål 1775: 40 (type locality, Lohaja and Jeddah).

Labrus punctulatus Lacepède, 1801: 431, 477, pl. 17, fig. 2 (type locality, “le grande golfe de l’Inde” = Indian Ocean).

Serranus flavimarginatus Rüppell, 1830: 109 (type locality, vicinity of Mohila).

Serranus roseus Valenciennes in Cuvier and Valenciennes, 1828: 306 (type locality, Tahiti).

Serranus luti Valenciennes in Cuvier and Valenciennes, 1828: 363 (error for *louti*).

Serranus phaenistomus Swainson, 1839: 201 (on *Serranus louti* of Rüppell, 1828, pl. 26, fig. 2).

Variola longipinna Swainson, 1839: 202 (on *Serranus louti* of Rüppell, 1828, pl. 26, fig. 2).

Variola melanotaenia Bleeker, 1857a: 33 (type locality, Ambon).

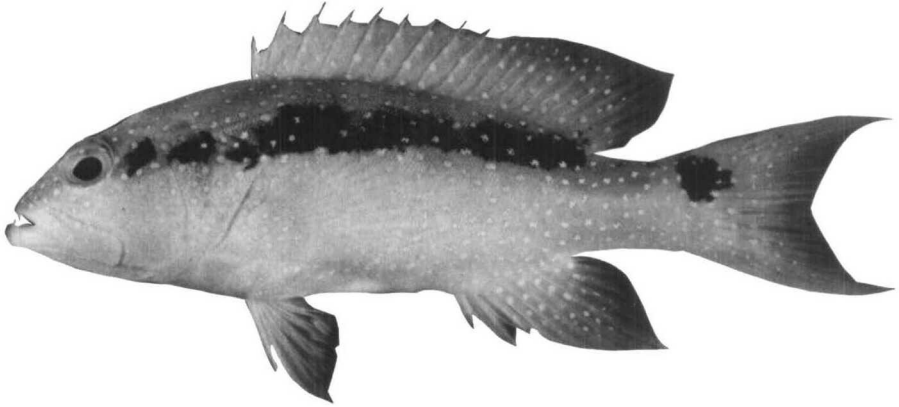


Figure 26. *Variola louti*, BPBM 8086, 94 mm SL, Palau Islands.

Diagnosis.—Dorsal rays IX,14; anal rays III,8; pectoral rays 16 to 18 (usually 17, rarely 16); pored lateral-line scales 66–77; oblique scale rows from upper end of gill opening to caudal-fin base 113–135; scales of body ctenoid except thorax and abdomen; snout, suborbital, and interorbital space naked; auxiliary scales absent; gill rakers 7–9 + 15–18; depth of body 2.8–3.2 in SL; head length 2.6–2.85 in SL; snout length 3.3–3.9 in head; suborbital depth 7–10.3 in head; interorbital space moderately convex; maxilla extending to or slightly posterior to orbit, the upper jaw length 2.0–2.15 in head; one or two (sometimes a smaller third) large, fixed, curved, canine teeth on side of lower jaw (in addition to one or two pairs of strong canines anteriorly); small teeth on posterior half of lower jaw in two or three rows; nostrils small, about equal in size; middle opercular spine closer to lower than upper spine; posterior margin of preopercle finely serrate, the serrae disappearing on large individuals; third to ninth dorsal spines subequal, the longest 3.0–3.65 in head; membranes of spinous portion of dorsal fin not incised; soft portion of dorsal fin very angular, the tenth dorsal ray longest, 1.4–1.9 in head; soft portion of anal fin even more angular, the fifth ray longest, 1.1–1.35 in head; caudal fin of adults lunate, the caudal concavity 1.3–2.15 in head; pectoral fins somewhat

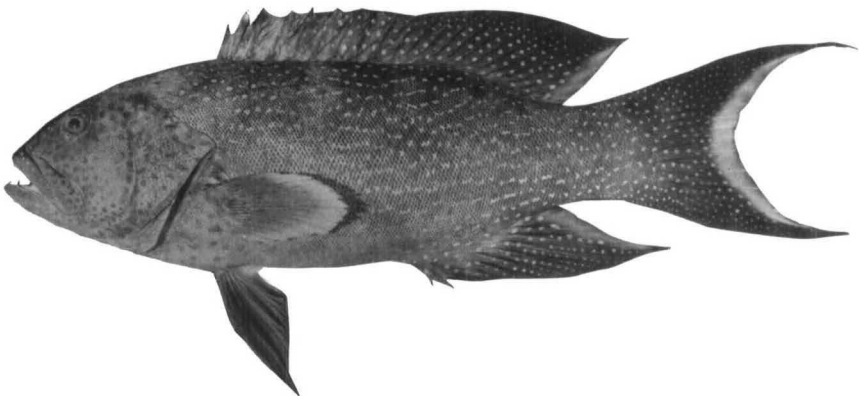


Figure 27. *Variola louti*, BPBM 8980, 267 mm SL, Marshall Islands.

pointed, 1.65–1.85 in head; pelvic fins of adults long, reaching to or posterior to anus, their length 1.2–1.6 in head.

COLOR IN LIFE. Yellowish brown to orange-red (more red in deeper water), the head, body and median fins with numerous small irregular spots which may be pale blue, lavender or pink; posterior edges of fins broadly yellow (this color less distinct on pelvics).

Remarks.—The above diagnosis is based on 17 specimens from the Red Sea, Seychelles, and islands of Oceania from the Academy of Natural Sciences of Philadelphia, Bishop Museum, and U.S. National Museum of Natural History. Measurements were made on 10 of these, 146–323 mm SL.

This well known grouper occurs from the Red Sea and coast of East Africa south to Durban (Smith, 1953) and east to the islands of Oceania except Lord Howe Island, Easter Island, and the Hawaiian Islands (Kamohara, 1958, was mistaken in including Hawaii in the distribution of this species). In the western Pacific it ranges from southern Japan (Masuda et al., 1975) to southern Queensland (Grant, 1978).

V. louti is a coral-reef species occurring from relatively shallow water to at least 100 m. Kyushin et al. (1977) recorded it to depths of 160 m from the Andaman Islands and Chagos Archipelago, but it is clear from their illustrations and color notes that they had confused *louti* with a second species of the genus, *V. albimarginata* Baissac, described from Mauritius. The latter species is most easily distinguished from *louti* by lacking broad yellow borders posteriorly on the fins; the caudal has a narrow white posterior margin and blackish submarginal line in the central part of the fin. The Bishop Museum has specimens of *V. albimarginata* from Mauritius, Réunion, Philippines, Taiwan and Okinawa.

Baissac (1956) recorded the total length of *V. louti* to 750 mm. The largest taken by the senior author, from Washington Island, Line Islands, measured 560 mm SL, 810 mm total length, and weighed 5.45 kg. Another caught by hook and line in 92 m off Rapa (BPBM 12973) was 502 mm SL, 730 mm total length.

The holotype of *V. louti*, ZMC 43566, a dried half skin 224 mm SL, is in the Zoological Museum, Copenhagen. It was illustrated by Klausewitz and Nielsen (1965: figs. 19).

Boulenger (1895: fig. 14) provided a drawing of the cranium of *V. louti* in dorsal view.

A difference was noted in the number of oblique rows of scales on the body of specimens from the Red Sea and Seychelles and those from islands in Oceania. The former group has 113–126 scale rows, whereas the latter has 128–135. The counts of lateral-line scales show a difference only in the broader range for Red Sea-Seychelles fish: 66–77, compared to 73–76 for specimens from Oceania.

V. louti has a bad reputation for occasionally causing ciguatera at oceanic islands of the Indo-Pacific. It is forbidden to be sold in the fish markets of Mauritius.

Randall (1980b) summarized previous data on the food habits of *V. louti* and added data from the examination of stomach contents of 44 specimens from islands of the Pacific. Fishes dominated the stomach contents though a few individuals had eaten crustaceans. The ingested fishes included acanthurids, balistids, chaetodontids, holocentrids, labrids, mullids, muraenids, pomacentrids, scarids, and scorpaenids.

Fowler and Bean (1930) were in error in placing *Perca irrorata* Forster in the synonymy of *V. louti*. The Forster species is a valid *Epinephelus* known only from the Marquesas Islands and Minami Tori Shima (Marcus Island). *E. spiniger* (Günther) is a junior synonym of *E. irrorata*.

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